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THE WORLD FOOD SITUATION *

By

LORD BOYD ORR, D.S.O., M.C., F.R.S.

Veterinary Medicine is one of the few branches of science in which knowledge can be increased and applied without the danger of doing more harm than good. The advances of physical science in the last 50 years are a positive danger to our civilisation. The aeroplane and the wireless have made the world so small and brought the nations into such close contact with one another that they must devise means of living together in peace. But this is difficult because each has its own historical and psychological background, its own religion and way of life, and its own nationalist and imperialistic ambition, and finds these threatened when it is suddenly thrown against other nations with different ideologies and ways of life, each nation being afraid of infiltration of alien ideals.

The rapid advance of technology in industry is not an unmixed blessing. I am referring not to the atomic bomb but to the economic system. The new raw materials and the rapidity with which they can be transformed into finished goods has enabled us to produce all kinds of industrial goods in abundance. In the U.S.A., which was outside the battlefield, industrial production has increased by 100 per cent. during the war. There is difficulty in getting the output of modern industry dispersed and consumed. Unmarketable surpluses lead to unemployment. In the U.S.A. unemployment has now reached 3½ million. Unless world markets can be expanded there is the danger of unemployment in all highly industrialised countries, leading to another world economic crisis.

The advance in human medicine is raising the problem of whether the earth can be made to provide food for the rapidly increasing population. At the present rate of increase of 22 millions a year, the pre-war population of 2,000 millions will reach 3,000 in 40 years. If preventive medicine be applied to the elimination of disease in Asia, Africa and Latin America, where the expectation of life at birth is only 30 to 40 years, as it has been in Western Europe, North America, and the British Dominions, where it is now 60 to 70 years, the rate of increase will be much faster. In an area of New Guinea where insect-borne diseases were eliminated, the fall in the death rate has been so great, especially among children, that the rate of increase has risen to 10 per cent. per annum. In Sardinia, where preventive medicine is being applied under the supervision of the Rockefeller Foundation, the infant mortality rate has fallen by over 60 per cent. in two years.

While the population is increasing, the area of fertile land which can be easily cultivated is decreasing through soil erosion, due to the pressure of population on the land. Vogt, the head of the Pan-American Soil Conservation Service, in a recent book, suggests that preventive medicine should be curtailed until disease and famine reduce populations of overcrowded countries to what their land will carry, and birth control measures be applied to prevent an increase above that level.

With modern agricultural and engineering science, world food production could be doubled in less than 25 years, provided governments would co-operate in a world food plan such as I suggested in 1946 when I was Director-General of F.A.O. and which was approved by the United States and welcomed by the majority of governments. But it is difficult to do with each nation pursuing its own policy, within its own territory. Some have not got the industrial products for the necessary flood control and irrigation schemes, and agricultural equipment. Some are trying to bring new land into cultivation and finding the cost exceeding the original estimate. Others, on the other hand, find the production of cereals and sugar for human consumption and coarse grains for animal feeding so easy that they are afraid of unmarketable surplus. The U.S.A. increased wheat production by 70 per cent. during the war when there was a market at a good price for everything which could be produced. Now prices are falling and farmers are cancelling their orders for industrial products and so contributing to the growing unemployment.

Feeding the world is not so much a scientific problem. Science knows the answer. It is rather one aspect of the general economic and political problem. The chaotic state of the world to-day is due to the difficulties of adjusting an international political system which evolved when the horse was the quickest means of transport and communication, to one to suit the aeroplane and the wireless, which make old political boundaries meaningless and change the economic system which evolved in a world of scarcity, to one which can carry the great potential wealth which science has made possible.

Veterinary Science has not, so far at least, raised any political or economic problems. The world is desperately short of animal products, and in some countries, especially in Asia, of work bullocks. This shortage can be made good by the elimination of disease and better feeding and management. The advances in veterinary medicine are comparable with those in human medicine. Indeed, it is the same science, though one branch is applied only to human beings, whereas the veterinary branch has to deal with all species of domestic animals. The rapid development and application of veterinary science can do nothing but good. If at some distant date we find we have too many animals we can, unlike human medicine, kill off the surplus, the worst, and so improve the breeds.

The great success which Veterinary Science has achieved in eliminating diseases where it has been applied is an indication of what can be done on a world scale. In the control of cattle diseases there are three phases: the eradication of the major "killing" diseases, the control of chronic infectious diseases associated with intensive farming, and the avoidance of metabolic troubles apparently connected with excessively high productivity.

The countries still in the first phase of animal disease control are India, many parts of Africa, and Eastern Asia. In these countries major epizootics, such as cattle plague (rinderpest), bovine pleuro-pneumonia, glanders, and certain protozoal diseases cause high mortality, and, consequently, the value of the individual animal and its produc-

* Basis of Plenary Lecture delivered before the XIVth International Veterinary Congress, London, on August 8th, 1949.

tivity is low. Nevertheless, the monetary losses, as well as the losses in food, are enormous. For example, in India, where the total food-producing animal population is well over 200 million, the mortality from cattle plague was, until recently, well over 50 per cent. Since the introduction of preventive inoculation, however, this loss has been reduced by one-tenth of this. It still remains high, however, the loss being in the region of one million head of cattle per annum. There is little doubt that this could be still further reduced if the veterinary services were extended. As an indication of the value of the food loss arising from animal disease in the Indian Union, it has recently been estimated that this is in the region of six million rupees a year.

Another result that indicates clearly the value of disease control measures is the scheme carried out in China by

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(Honorary Member, N.V.M.A.)
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F.A.O. where 300,000 water buffalo were recently inoculated against cattle plague. The majority of these animals were thereby prevented from dying and were, consequently, able to plough the land. Normally each buffalo ploughs in a year land which will yield five tons of grain, so it is estimated that over 100,000 tons of extra grain were grown as a result of these veterinary measures.

Great Britain has passed to the second and third phases in the control of animal disease, having eradicated cattle plague since 1866. Nevertheless, it is interesting to remember that in this type of control stringent measures must be adopted as otherwise the eradication of the disease may be very tardy. For example, there was a great outbreak of cattle plague in this country in 1714 when strict measures of control were introduced, and the disease was eradicated within three months. In 1745, however, when another widespread epizootic occurred, the control measures were applied only half-heartedly, and the disease was not eradicated for 15 years. Even in the last outbreak of rinderpest in Great Britain in 1865–66 the number of cattle involved was 324,000. Let us hope that the present loss of eggs and poultry meat arising from the re-introduction last year of fowl pest into this country will not be allowed to continue through the adoption of half measures. It is essential that veterinary police measures be associated with the elimination of sources of infection, a fact which may cause us to stop the importation of poultry meat from certain countries where this disease still exists.

Once the major "killing" diseases are brought under control, livestock farming usually becomes more intensive and certain chronic infectious troubles arise. Great Britain may be considered to be in this state, as indeed now are many of the Commonwealth and Colonial territories, the countries of Western Europe, and the United States of America. The diseases causing greatest losses in these countries are mastitis, contagious bovine abortion, tuberculosis in some, infertility, and parasitic diseases. These diseases refer mainly to cattle, but there are similar diseases for the other domesticated animals. From some of these countries tuberculosis of cattle has been eliminated by a combination of detection and slaughter of infected animals, and the adoption of hygienic methods of management. For example, tuberculosis in dairy cattle with its dangers to the human population has been practically eliminated from the United States and certain other countries. The eradication scheme in the United Kingdom has been intensified recently, but is still a long way from success, owing largely to the difficulty in controlling the disposal of the infected animal.

The other diseases in this group—mastitis, contagious abortion, infertility and parasitic diseases—all give rise to great losses. A recent estimate of the monetary loss per annum arising from diseases in dairy cattle in the United Kingdom is of the order of £30 million, or in terms of food value 200 million gallons of milk. These losses have been curtailed to some extent by the recent use of sulphonamide drugs and penicillin, and the wide application of a vaccination scheme for the control of contagious abortion.

As these chronic infectious diseases are brought under control animal productivity increases, and a number of digestive or metabolic disturbances occur. Sometimes these troubles are associated with a deficiency in the pasture, such as cobalt, copper, or phosphorus, which may give rise to death or extreme weakness in large numbers of animals. Cobalt deficiency pining, which is very prevalent in sheep in Australia, New Zealand, and certain parts of this country, has been largely controlled by the addition of cobalt to the pastures. Many years ago it was difficult to keep cattle under ranching conditions in much of South Africa, but the trouble has been largely overcome through the widespread use of bone-meal supplements. Many other deficiency diseases exist and methods are known for their control, but there are still many which have not yet been unravelled.

To sum up: It is evident that there are many diseases of animals causing huge losses in food-stuffs such as milk and meat throughout the world. Whilst in certain countries these losses are, to some extent, controlled by an efficient veterinary service, in many others the facilities for this service have not been granted. If the control of animal disease could be organised on a world-wide basis, there is no doubt that with our present knowledge we can enormously increase the amount of dairy and meat products available for human consumption. It is difficult to estimate the loss in human food-stuffs throughout the world due to preventible diseases in animals, but it must run to millions of tons per annum.

Here there is a great field for Veterinary Science. Unfortunately, like all other branches of biological science which

XIVth International Veterinary Congress

OFFICIAL OPENING

The XIVth International Veterinary Congress, which is being held in Great Britain under the gracious patronage of His Majesty the King, was formally opened by Mr. Hector McNeil, M.P., Minister of State, at the Central Hall, Westminster, on Monday, August 8th. Amongst those supporting Sir Daniel Cabot (acting President) on the platform were Professor T. Dalling (Chief Veterinary Officer, Ministry of Agriculture, and President of the Royal College of Veterinary Surgeons), Dr. R. F. Montgomerie (President N.V.M.A.), Sir Weldon Dalrymple Champneys, of the Ministry of Health, Dr. B. T. Simms (U.S.A.), Professor Vergé (France), Professor Fluckiger (Germany), Dr. W. R. Wooldridge, and Mr. G. N. Gould. The great majority of the 1,000 delegates and their ladies were present.

Election of President

The first business was to elect a President of the Congress and Dr. W. R. Wooldridge proposed the election of Sir Daniel Cabot to this office, which was agreed to unanimously.

Declaration of Opening of Congress

The Rt. Hon. Hector McNeil, M.P., Minister of State, in declaring the Congress open, said that he was not quite clear why it was appropriate that a Minister of the Foreign Office should be invited to do so but he suspected that it was a good thing for the Foreign Office to take part in an international conference where there was a likelihood of agreement! (Laughter and applause.) He noted when he studied the history of the Congress that there was embodied in its history an idea which was not at all strange to this Government, or, indeed, to any British Government, for he was told that 86 years ago when Europe was confronted with a devastating cattle plague, a distinguished British veterinarian, Mr. John Gamgee, conceived the idea of holding a veterinary congress, his reasoning, the speaker imagined, being that here was a problem which might be visited upon any state and which certainly could not be solved by the action of any one state; it needed international agreement to tackle a problem of that dimension.

The theme of the Congress was the world food supply and he was certain that the distinguished Scotsman, Lord Boyd Orr, would take care that the Congress got a strong and vigorous key note to start that subject. It was a theme which Lord Boyd Orr had pursued for many years. It was an urgent one. Hunger was international currency and the scientists, teachers and practitioners gathered together would discuss that thesis as an expansion of their activity.

As a member of the British Government he wished the Congress great success in its attack upon this problem, for the area where immediate application of conclusions such as theirs was anxiously awaited was tremendous. For instance, he never missed an opportunity of saying that he was obsessed by the possibilities of Africa; there seemed to be almost no other area where the opportunity for development of food and raw material production was so immense. He had great optimism in this field, that because of the approaches made by the veterinary profession in recent years, it might not be too long before some of the difficulties disappeared. We lived in a difficult time but it was a most exciting time and he could not believe that there had ever been a period when the opportunities for the scientists were greater, and the rewards, if not very large in monetary form, very substantial for the scientist.

He had said that hunger was international currency, he would add that knowledge also was an international asset. It was a matter of the deepest and most disturbing regret that this was not universally accepted but the composition of the Congress at which there were delegates from 53 countries, including 20 from the Commonwealth, was very encouraging and he congratulated the Organising Committee most warmly on the wideness of the area from which delegations had been drawn. He was satisfied that each delegation would return to its own country enriched by its experiences here; an important facet of the Congress was that it provided an opportunity for free submission of ideas, for examination of ideas in a scientific and not in a political atmosphere.

On behalf of the Government he wished the Congress great success and he would beseech the delegates to see that their conclusions reached as wide a field as possible. (Applause.)

The President thanked Mr. Hector McNeil for his inspiring address.

Congress then approved the sending of a message to H.M. The King at Balmoral offering humble and loyal greetings and expressing deep gratitude for his gracious patronage of the Congress.

Election of Honorary Presidents and Vice-Presidents

The following distinguished members of the profession were honoured by being elected Honorary Presidents of the Congress:

Professor C. Guèrin	Dr. J. Mohler
Professor L. de Blieck	Dr. J. Marek
Professor E. Leclainche	Colonel Max Henry
Dr. P. J. du Toit	Professor Magnusson

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seek to enrich the world in the equal interest of the people of all countries, it is starved for funds. The veterinary profession need a strong international organisation, on the lines of the World Health Organisation, through which governments could co-operate more actively in the elimination of preventible diseases on a world scale. It might be linked up as part of, or at least closely allied with the Food and Agricultural Organisation. The difficulty is to get the necessary funds and get governments to co-operate. It is perhaps to a Congress such as this that the world must look for a lead. You already have your International Veterinary Committee which, with full support from veterinary organisations throughout the world, might become sufficiently strong to persuade governments to give it the necessary money and power.

I venture to suggest that in addition to considering technical problems which are of interest mainly to the professors, this conference should consider ways and means of bringing about a greater unity in the veterinary work of different countries, and how best the research stations and services of the better equipped countries can assist those who are worst equipped and in most need of the application of veterinary science. By such international co-operation in applying science for the benefit of the people of all countries, governments may become less obsessed with political conflicts and more inclined to work together for their mutual advantage to create a world of plenty. Scientists and professional men who know what modern science can do if applied on a world scale should urge governments to co-operate in constructive measures which can be kept out of the area of political conflict. Such international co-operation can be an important step to a world of unity, prosperity, and peace.

The following were elected Honorary Vice-Presidents on the proposal of Professor G. H. Wooldridge, seconded by Mr. G. N. Gould:

Professor T. Dalling
Professor J. B. Buxton
Dr. R. F. Montgomerie

Dr W. R. Wooldridge was elected General Secretary, and Mr. G. N. Gould Honorary Treasurer of the Congress, on the proposal of Professor W. C. Mitchell.

President's Address

Sir Daniel Cabot:—Eleven years have elapsed since the last Congress was held in Switzerland. During part of this period the world has seen unparalleled destruction of life, of property, and of the means of providing for the well-being of the people. On the other hand, this period has been fertile in discovery.

Remarkable advances have been made in all branches of science, including veterinary science, which, in addition to developments of purely veterinary character and application, has derived inspiration and aid by discoveries in allied spheres. Among the outstanding developments of the past decade are: the application in general practice of the drugs of the sulphonamide group; the use of penicillin and the promise of other anti-biotic preparations; the new parasiticides—phenothiazine—and preparations for the destruction of external parasites; the introduction of antrycide—the latest weapon against trypanosomiasis; the development of effective vaccines for the immunisation of animals against foot-and-mouth disease; the widely extended use of brucella strain 19 for the protection of cattle against contagious abortion; the extensive use of artificial insemination; the advances in research in rinderpest, including the artificial cultivation of the virus and also its adaptation to the rapid advances, full of promise, in the campaigns for the eradication of the most serious menace to the cattle industry.

This indeed is an arresting statement on progress in the veterinary field of which the profession may well be proud. One may go so far as to venture the prediction that a future generation will regard the results of the labours of the past decade as no less beneficial to the livestock industry than the discoveries of any similar earlier period.

These, as well as other advances in veterinary science, fully justify the convening of this Congress in order that the many aspects of the application of new changes and new methods for the control of animal disease may be debated, and profit be derived from the experience of their use in different conditions in the many countries represented in this assembly.

In this realm of discovery two factors may be signalised. The first is that workers in many countries have contributed to these advances. Hence the advantage of international discussion of their application; the second is the new approach to the control of certain infections of livestock.

In the past we have regarded prophylaxis as the only means of ensuring the freedom of herds and flocks from contagious disease. But that view no longer holds good, for to-day we can visualise the elimination of certain diseases—for example, streptococcal mastitis from infected herds—by the treatment and rapid cure of infected animals. We owe a duty of gratitude to our confrères in the medical and chemical professions who have enabled us to approach the problem of streptococcal mastitis in this new manner, which will be so highly appreciated by the dairy farmer.

Nevertheless in the case of other diseases the efficacy of prophylaxis cannot be questioned and prophylactic measures will continue to be the most dependable means of securing the health of the herd or of the flock.

Now, partly as a result of the world war and partly as a result of other causes, the human race faces a deficiency in the supply of food stuffs, particularly food of animal origin. The agricultural industry and the veterinary profession know full well that one of the limiting factors to output of the wide range of animal products needful to man—meat, milk, and dairy products, poultry and eggs—is the prevalence of disease.

Consequently, the Organising Committee of this Congress has prepared an agenda directed chiefly to those conditions which most seriously limit the production of food for man. By pooling our knowledge and our experience we shall contribute towards the solution of one of the most pressing problems of the day, and at the same time improve the economic condition of the livestock industry.

The scope of this Congress is even wider, for it touches also upon questions of diseases transmissible to man—in a word, the public health question.

Let us also not overlook the humanitarian side of our work. We deplore the infliction of cruelty, often the result of ignorance. We applaud the advances in anaesthesia and medicine for the relief of pain. It is not always recognised that the control or the elimination of disease means a reduction in suffering among animals.

Thus we impose upon ourselves the obligation to increase the well-being of the lower animals so that their increase and production may be of greater benefit to mankind. Only by an international gathering of this character can this obligation be accomplished.

The holding of this Congress is timely—its importance cannot be exaggerated.

On behalf of the British veterinarians I offer a most cordial welcome to all those who have come from overseas. We thank you for your presence; we are delighted to have you with us and we shall do all we can to make your visit interesting and memorable. (Applause.)

Contributions by Foreign Delegates

Dr. B. T. Simms (U.S.A.) said that the English-speaking members of the Congress came from every corner of the world and it was a privilege and honour for him to represent them. They were very glad to be able to meet and discuss with confrères from all parts of the earth the many problems which confronted them, particularly the problem of food.

In considering the problem of food and food production there were certain axiomatic truths which should be taken into consideration; first, that without the veterinary profession there could be no economic and abundant production of animals and the foods which were of animal origin; second, without the economic and abundant production of animals there could be neither permanent preservation of our soils nor satisfactory nutritional standards for our populations, and, third, unless there was permanency of the soils and well-nourished people we could not have an enduring civilisation. By coming to this Congress veterinarians were carrying with them the serious responsibility of doing their part in the production of foods and finally in the preservation of civilisation. They were, therefore, appreciative of the opportunity to meet with the different groups from all sections of the earth to discuss those things which were so important and necessary for the maintenance of civilisation throughout the world.

Professor Vergé, speaking for the French-speaking countries, said that the Congress was meeting for the third time in Great Britain. He said that this troubled world was split between fear and hope, the way of life was changing,

and it was good to meet in a country whose traditions and energies deserved the gratitude of the profession. He extended to the President and the Organising Committee warmest thanks and good wishes for the success of this Congress; he was certain it would be a success in the recovered atmosphere of cordiality and the work which had been begun by previous international congresses would be continued. This Congress would be the starting point of a new era of prosperity, peace and agreement and would give a definite incentive to the veterinarians of all the world towards achieving a glorious destiny.

Professor Fluckiger addressed the Congress in the name of countries whose language was German. In spite of travel difficulties the attendance was very large because the subjects on the agenda were extremely interesting. This was the first international veterinary congress which had stressed the importance of medical-veterinary science in human nutrition and for the first time lectures were to be given on the promotion of animal production and its relation to good health. This subject was increasingly important on the international level as well as the national level. He was grateful to the Organising Committee for putting this as the main item on the agenda. He would like to say in the name of those he represented how happy they were to be able to co-operate and collaborate in this Congress.

All three speakers were warmly applauded, and the President thanked them for their message. After Dr. W. R. Wooldridge, General Secretary of the Congress, had given out some notices and general information for the delegates, Lord Boyd Orr gave the first address on "The World Food Situation," an extended summary of which appears at the commencement of this issue. The address—a very "human" one in both subject and delivery—was heard with immense appreciation by the assembly, whose thanks were voiced by Professor Dalling and Dr. Montgomerie.

Westminster Abbey Service

In connection with the fourteenth International Veterinary Congress a special evensong, by kind permission of the Dean, was arranged at Westminster Abbey on Sunday evening, August 7th. The President and Council of the Royal College of Veterinary Surgeons were present, as well as representatives of other bodies, and delegates to the Congress attended in large numbers, the choir and transepts being filled, while many sat in the nave. The preacher was the Rt. Rev. J. A. G. Housden, Bishop of Rockhampton, Queensland, whose sermon was on the injunction to matter-of-fact duty after the experience on the mount of transfiguration. He made only a passing allusion to the occasion, saying that the Abbey Church was fulfilling its age-long tradition in giving a welcome to any body of scientists who came to London from various parts of the world to share their experiences and to be enriched by the mutual exchange of ideas. This body of veterinary scientists, he said, were welcomed as men and women who in their task of alleviating the sufferings of the animal creation and of increasing the contribution which veterinary science made to human welfare, recognised their work as a vocation for which it was right to give praise and glory to God. The Bishop then went on to speak of his own huge diocese and its peculiar difficulties, and of the claim which the lonely Dominion spaces had upon the prayers and interest of the Church at home.

The service closed with a special intercession for the Congress by the Dean of Westminster, the Very Rev. A. C. Don, K.C.V.O.

Reception by the President and Council of the Royal College of Veterinary Surgeons at the Guildhall of the City of London

By kind permission of the Lord Mayor and the Corporation of the City of London, the spacious hall, library and crypt of the historic Guildhall were made available, on Monday evening last, for a reception by the President and Council of the Royal College of Veterinary Surgeons to all delegates to the International Congress and to all their wives who were associate members.

It is estimated that over a thousand guests were received by the President, Professor T. Dalling, and by the Senior Vice-president, Mr. Howard Dawes, and the Treasurer, Professor J. B. Buxton, who were supported by the Secretary and Registrar, Mr. W. G. R. Oates, and the Mace-bearer, holding the very beautiful Mace of the Royal College.

The presidential group in colourful robes with the gold of the President's chain and the Mace made a fine picture in the art gallery of the Guildhall, where the guests were received.

In the Guildhall itself under the historic flags and surrounded by monuments which had escaped the devastation caused by the air-raids the guests circulated and many old acquaintanceships were renewed. In the Gallery the string band of the Royal Artillery played throughout the evening.

Refreshments were served at buffets in the Gallery itself and in the crypt. The museum with its many interesting objects recording the earlier history of London was visited by everyone as was also the collection of antique clocks.

In the Library was a small selection of the historic records of the Royal College of Veterinary Surgeons. The original Royal Charter of 1844 was on exhibition for the first time in many years having been removed from the vaults where it is normally kept in safe custody. Another colourful piece of fine handwriting and painting was the Royal Grant of Arms made in 1844 to the Royal College.

Not far from each other were the first printed Register of Veterinary Surgeons and the original manuscript Register of Veterinary Surgeons open at the first page and showing entries in 1844. This period, of great interest to the veterinary profession, was also covered by the original minutes of the committee of veterinary surgeons which met in London in the years prior to 1844 and by whose efforts the first Royal Charter was obtained. Appropriate to this period was the case-book of Edmund Gabriel, who was also a member of the Royal College of Surgeons and a member of the Royal College of Veterinary Surgeons.

Two other interesting exhibits were manuscript notes taken of Coleman's lectures delivererd at the Royal Veterinary College about 1809 and a prescription book of about 1750 in which the veterinary surgeon writer lending it to a friend besought him to return it "Least Tybourn be your bitter end".

Coming to more recent times and very appropriate in view of the Act of 1948, was the original Register of Existing Practitioners under the Veterinary Surgeons Act of 1881. This was open at the page which showed the two remaining entries in this Register: those of Mr. H. F. Sparrow, of Rochford, Essex and Mr. M. T. Sparrow, Baddow, Essex, both of whom we understand to be approaching their century and still in good health. Together with the original Register were shown the form of application and certificate as to character which had to be filled up by applicants at that period.

(*Concluded at foot of next column.*)

THE VETERINARY RECORD
August 13 1949

A MOMENTOUS WEEK

SINCE the International Veterinary Congress last met—in Switzerland, in 1938—the civilised world for the second time has been plunged into chaos by war, with yet graver impairment of its powers of recovery. The primary struggle to return to normality in the realm of food production has been complicated by adverse economic and political factors, but at long last this goal has emerged starkly as the overriding task confronting mankind.

Outstanding amongst those responsible for universal recognition of the urgency of the problem is our Honorary Member, Lord Boyd Orr, formerly Director-General of the Food and Agriculture Organisation, United Nations, who thus most appropriately presented to the XIVth International Veterinary Congress the opening paper on "The World Food Situation", a summary of whose masterly address is reproduced at the commencement of this issue. As also recorded herein, the Congress had been opened officially just previously (on Monday last) by the Rt. Hon. Hector McNeil, M.P., Minister of State, while a large number of the 1,000 or more members with their ladies were present at the special form of Evensong held on Sunday in Westminster Abbey, attended officially by leading representatives of the profession and its organisations.

The frame-work of the Congress was filled in, at the start of each day by the Plenary Sessions and by the ensuing consideration of the scientific papers—to be reviewed in these columns in due course—furnished by veterinary scientist leaders in their respective fields, reporting upon the remarkable advances that have been made in veterinary medicine towards the control of diseases amongst livestock. As Sir Daniel Cabot, the President of the Organising Committee, wrote in our issue of July 23rd: "The need of expansion of livestock products during the period of hostilities contributed very markedly to the quick introduction into general practice of new means of limiting losses of production. In this respect the time lag so often observed in the past in the application of new methods was eliminated, but the cessation of hostilities has left many problems, and particularly the question of adequate supply of food for man. The XIVth International Congress, therefore, will be based strictly on the needs of the moment, and the means whereby the veterinary profession can best play its part in the world crisis."

Going to press, as we do with this issue, shortly after the "International" has got fully under way, we cannot as yet do more than record the impression that the venture of faith in selecting this country for the honour of holding the XIVth Congress is being well justified in the event. Despite serious difficulties of transport and finance, delegations—some of them large as well as influential—from 53 countries have been welcomed most warmly by their British host veterinarians both individually and by the Royal College, the N.V.M.A., our veterinary institutions and the Government. The sessions are crowded, the discussions well sustained and informative, and the social atmosphere all pervasive.

Towards the end of the week the "International" will have merged in to our own "National" Congress and we look with confidence to the carrying over of these attributes—and indeed in intensified measure—to our traditionally happy and impressive meeting. In our next issue we shall be in a position to deal retrospectively with both great events, with particular reference to the latter, devoted as it will be primarily to practice amongst small animals.

Already many tributes have been paid by delegates to the Congress of every race and tongue to the dignity of the reception and to the friendly atmosphere which existed and it was with reluctance that the President had eventually to ask the band to play "God Save the King."

The President finally left the Guildhall after being heartily cheered by a small group of members of Council and other distinguished persons.

BIOCHEMICAL AIDS TO DIAGNOSIS

DISCUSSION BY THE CENTRAL VETERINARY SOCIETY*

Opening Contributions

I. By A. B. ORR,
HARROW, MIDDLESEX.

In offering a few points for discussion on the subject of biochemical aids to diagnosis I am treating it from the point of view of a general pathologist, illustrating my remarks by reference to cases which have been encountered in routine laboratory diagnosis.

I feel that the subject may best be approached in the following way; a very large number of chemical compounds enter into and are necessary for animal metabolism; the nature of these substances varies from that of simple inorganic salts (such as sodium chloride) to highly complex organic compounds (such as some of the vitamins and hormones). In many cases the maintenance of health depends, not merely on the presence of these substances, but also on the maintenance of their quantity or concentration within certain limits. (We can recall from our early lectures in physiology the way in which the threshold function of the kidneys prevents too high a concentration of some of the blood constituents.) Either too much or too little of a substance may result in the animal becoming ill. For the purpose of this discussion, therefore, we can conveniently divide disease into two types: (1) illness due to a decrease of a substance below a minimum value, and (2) illness due to an increase above a maximum value. The first type we speak of as a deficiency disease, and this side of the question will be discussed by Dr. Harvey. The second type, where illness is due to the presence of a substance in excess, forms a connecting link between biochemistry and toxicology. The animal is, in fact, poisoned, and I wish to discuss briefly the value of biochemical aids in this class of disease.

Apart from cases of, say, strychnine or arsenical poisoning where analysis reveals the presence of overwhelming amounts of the poison, there are many conditions in which biochemical aid is required to confirm or refute a diagnosis made on clinical or *post-mortem* findings. All laboratory tests, biochemical or otherwise, should be regarded as "aids to diagnosis" and the results of the tests require interpretation, taking into account the circumstances of each individual case. In order to illustrate this point I have chosen two conditions in which biochemical analyses are usually called for, and in which the results of the analyses require careful interpretation in order to avoid a mistaken diagnosis.

*At the meeting held at the Royal Veterinary College, on November 4th, 1948.

Doping in Greyhounds

May I remind you that I am discussing this subject purely from the point of view of the value of a " biochemical aid."

Suspected cases are extremely common, and proof of " doping " is usually sought by having an analysis carried out on a sample of urine or vomit, or both. The analyst is presented with the specimen, frequently without any information as to the symptoms shown by the dog, but from the brief notes that sometimes accompany samples sent to the laboratory it appears that suspicion is aroused when the dog shows loss of speed or falters in running: when it exhibits lethargy, inco-ordination of movement or unsteady gait; or when it shows excessive speed, excitement or "fits." It is important to remember that the test has certain limitations; for example, while some of the drugs used for doping, such as phenobarbitone, are excreted in the urine, others are completely oxidised in the body and do not appear in the urine at all (*e.g.*, nembutal).

Bearing this qualification in mind, we can say that a negative result in a suspected case of doping means that the dog was not doped; but in this case what caused the symptoms that raised the suspicion of doping? The negative result has merely eliminated one possible cause; it has not supplied the diagnosis, and the veterinary surgeon should regard it as a clear indication that the case requires further investigation to discover whether the symptoms were not in fact the result of natural disease. Recently nine samples of urine and three samples of vomit were received for analysis with the history that at 7 a.m. the dogs were very drowsy when stirred, showed lack of equilibrium and very unsteady gait, and some of them fell over when turned or stopped suddenly. All the samples proved negative. Obviously this was a case where a more thorough examination aided, possibly, by other laboratory tests, was required to discover the cause of the symptoms, although an analysis for doping was necessary to satisfy the stadium authorities.

A positive result in an analysis for suspected doping is, of course, evidence that the animal has received the drug. I assume that one can exclude the legitimate use of the latter in the form of a medicine; if the animal is sufficiently " off-colour " to require dosing, would it be passed as fit for racing? The positive result gives a direct answer to the question " has this animal been doped?", but it does not answer the equally important question " are all the symptoms shown by the animal entirely due to the drug?". In other words, all the symptoms may be attributed to doping in error. The following case illustrates the point that a dog that has been " doped " may also be suffering from natural disease.

The subject was a three year old greyhound dog which had always appeared fit, fed well, and was a good stayer. He was seen at the kennels at 6 p.m. when put into a motor van with seven other dogs. He was kennelled at the stadium at 6.45 p.m. As he was of an " excitable temperament " his lead was fixed to a hook above the bed to keep him away from the door of the kennel. At 8.15 p.m. he was dead with a pool of saliva beneath his head and the lead pulled away from the hook. The *post-mortem* examination revealed the presence of *beta haemolytic streptococcus* infection with sub-acute nephritis, associated with infection with *Ankylostomum* species, *Toxascaris* species, and *Taenia marginata*. The veterinary surgeon asked for an examination for evidence of doping in order to satisfy the stadium authorities. Toxicological analysis of the stomach contents revealed the presence of 1/55th grain of phenobarbitone per ounce, equivalent to approximately 1/28th grain in the total stomach contents.

Here was a case where, in addition to evidence of doping provided by the analysis, the *post-mortem* examination showed that the animal was affected with natural disease and must in fact have been suffering from it for some considerable time, although the trainer had observed no evidence of illness. The chemical analysis answered the question " has this animal been doped?", but essential information on which a diagnosis of the cause of death could be based was provided by the *post-mortem* examination.

Salt Poisoning

This condition is an example of illness due to the presence of a normal substance in excess. It occurs in pigs and poultry, and in spite of a large number of cases reported over very many years its occurrence has been disputed, particularly in pigs, chiefly on account of the fact that no one has succeeded in reproducing the disease experimentally. Slavin & Worden[3] (1941) described experiments in which they failed to reproduce salt poisoning by the administration of salt to pigs, and Worden[4] (1941) tabulates a number of similar attempts by other workers. It has been suggested that salt poisoning is in reality due to other substances (*e.g.*, trimethylamine in herring brine, solanine in the liquor from salted potatoes) or to traces of toxic impurities in crude salt, but these theories do not cover the clinical evidence extending now over a very long period of time, nor is the failure to reproduce a natural syndrome by artificial means confined to salt poisoning. It is interesting to note that the Feeding Stuffs Regulations issued during the war limited the salt content of animal foods to one and a half per cent. for cattle, one per cent. for adult poultry, and three-quarters per cent. for pigs and baby chicks.

In cases of salt poisoning confirmation of the diagnosis usually is sought by a chemical analysis of the crop or stomach contents. The following case is illustrative of the condition in poultry.

A mixed flock of six pullets, nine hens, four ducks and six drakes appeared normal when fed in the evening. The next morning four pullets and two ducks were found dead and two hens died during the day. The symptoms shown were crop-binding, the head held low and twisted, inco-ordination of the legs, and finally coma. A pullet and a duck were received for *post-mortem* examination. The pullet showed a mild duodenitis due to coccidiosis and the duck had a mild infection with threadworms. Analysis of the pullet's crop content showed the presence of 2.98 per cent. of salt and in the case of the oesophageal contents of the duck the salt content was found to be 1.87 per cent.

The proportion of salt found in the crop in these cases varies considerably; in some of our cases between seven and eight per cent. of salt has been detected, a remarkable finding when one knows that under experimental conditions birds usually refuse to eat heavily salted food. When quantities such as these are found, the biochemical test employed may be considered as conclusive support for the diagnosis of salt poisoning, but it is a different matter when the analysis reveals a salt content of the order of one per cent. The inference to be drawn in this case must depend on the clinical history of the individual case; indeed, Edwards[1] (1918) showed that an excessive amount of salt is not always present in the crop after death from salt

poisoning. He injected salt solution into the crops of three pigeons in the proportions of 2.5 gm., 3.33 gm., and 4.5 gm. of salt per kilogramme body weight. Two of the birds died and subsequent analysis of their crop contents revealed them to contain only 0.73 per cent. and 0.76 per cent. of salt, respectively, equivalent to the concentration of normal saline solution. As Edwards points out, an analysis in this case would not have furnished evidence of salt poisoning and consequently Lander's (1912) conclusion[2] that the chemical diagnosis of salt poisoning presents little difficulty on account of the high proportions found requires some modification. (This conclusion, which occurs in the first edition of Lander's "Veterinary Toxicology", has in fact been modified in the third edition published in 1945.)

When we have to deal with suspected cases of the condition in pigs I feel that Edwards' observation becomes even more important than in the case of birds. Possibly, salt is more rapidly or more readily absorbed from the pig's stomach than it is from the bird's crop, for in my experience the concentration in the former is never as high as it is in the latter after poisoning. In fact I am prepared to assert that not infrequently it is impossible to diagnose the condition from the result of an analysis and that the diagnosis must be based on the clinical findings. The importance of history and clinical symptoms is well shown in the following case.

A litter of nine 12-week-old pigs appeared well when fed in the evening on swill and home-grown oatmeal. The next morning one was found dead and three were staggering and salivating; when on their side these three galloped with their legs. Two more pigs then started staggering about and bumping into the sty wall; the head was held down, the animals stood in corners attempting to vomit but merely salivating, or ran backwards until they hit the wall, and apparently were unable to see. One of the affected pigs was destroyed by shooting and sent for *post-mortem* examination.

The examination revealed a slight degree of emaciation and anaemia with infection of the lungs with lung-worm. There was no evidence of bacterial infection. An analysis of the stomach contents which consisted of the remains of the evening meal and included potato, beans, french beans and some chop, all of a rather dry consistency, showed the presence of 0.58 per cent. of salt. A diagnosis of salt poisoning was made, based on the above findings.

As a result of the diagnosis the veterinary surgeon enquired into the composition of the feed given to the pigs on the evening prior to the appearance of symptoms. He found that on that day a 14-lb. jar of salted beans had been mixed with approximately 30 lbs. of cabbage and bread swill. About half of this mixture had been fed to the nine pigs. Unfortunately the remains of the feed had been disposed of, so that there was no opportunity of finding out the proportion of salt it contained. However, the significant point is that all the ascertained facts when considered together provide clear evidence as to the cause of the illness, yet the chemical analysis of the stomach contents revealed a salt content less than that allowed in national pig meal under the Feeding Stuffs Regulations. I doubt whether any toxicologist would suggest a diagnosis of salt poisoning if the only information at his disposal was a salt content of 0.58 per cent. in a stomach contents.

A consideration of these few notes on doping and salt poisoning helps us to assess the value of biochemical aids in the diagnosis of disease. There is no doubt that we can obtain help in investigating disease from biochemical tests, but we must be careful to keep in mind exactly what the particular test will do. A biochemical analysis will tell us whether a drug is present in a greyhound's stomach, or how much salt there is in a pig's stomach contents. It is when we come to apply this information to the particular case that there is a danger of placing too much or too little significance on the result of the test. We may assume too readily that all the symptoms exhibited by the patient were due to "doping" or salt poisoning, and omit to exclude the possibility of other factors being partly responsible. You may recall that in three of the four cases I have quoted, the *post-mortem* examination revealed evidence of infection with internal parasites. Is the greyhound affected with bowel worms more susceptible to a dose of "dope" than a healthy dog? Is the fowl infected with coccidiosis more susceptible to a heavy dose of salt than the unaffected bird? These questions become extremely important when we are trying to form an opinion as to the cause of illness or death. In fact, where we have a case of poisoning in an animal found to be suffering from natural disease we may have to try and answer the question "would this animal have been killed by the amount of poison it received if it had been healthy?" It is often a very difficult question to answer.

I am afraid that these remarks may suggest that my opinion of biochemical aids is not very high, but I certainly do not wish to give that impression. There cannot be any doubt as to the value of biochemistry to the veterinary surgeon. Apart from confirming the diagnosis there are circumstances in which it is indispensable; it would be very unwise, for example, to embark on a legal action for loss of stock from poisoning without having the case supported by the result of a toxicological analysis. I have, however, emphasised the point that one may be led astray, not by the biochemical test itself, but by the interpretation placed upon it. The result of the test is a fact; the interpretation of it is an inference, and as in the case of all laboratory tests the inference must be influenced by the other relevant facts. Biochemical "aids" (that is how they are referred to in the title of this discussion) are undoubtedly capable of helping the diagnostician and their value will probably increase provided that they are used to supplement, and not to supersede, clinical diagnosis.

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II. By D. G. HARVEY,

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In supporting Mr. Orr's most interesting paper I will not trespass on his preserves but will select my own method of attack.

Being a teacher as well as a research worker in biochemistry my approach will be along different lines from those adopted by Mr. Orr and will not, I trust, cut across them. I might add that we got together some time prior to this meeting and considered our several arguments.

It is my intention, therefore, to deal with three aspects in the time placed at my disposal: firstly, the dissemination

and utilisation of biochemical knowledge in relation to veterinary medicine: secondly, animal nutrition and dietary deficiencies: thirdly, that most interesting and complex subject at present receiving the greatest attention—the metabolism of the antibiotics.

I have picked these illustrations, not at random, but as representative examples of biochemical aids to veterinary medicine.

In many ways it is most unfortunate that the teaching of biochemistry is confined almost solely to junior veterinary and medical students and to those few honours graduates in chemistry who wish to enter a biochemical career. This arrangement sometimes appears to endow the subject with a false aura of mystery and complexity often referred to, I think a little unfairly, as " high falutin' ".

This state of affairs arises, rightly or wrongly, because the standards of training required for the making of a biochemist are maintained at a high level, and an essential preliminary in most universities is that the candidate must have an honours degree in pure chemistry together with a subsidiary biological or physiological qualification. Quite obviously this system of training is not altogether satisfactory because too often the biological side is depressed at the expense of the chemical. The fact remains, however, that until these preliminary qualifications are obtained nobody can become, at any rate officially, a biochemist.

It is also unfortunate that much biochemistry has become so commonplace that it is taken for granted. This applies particularly to the use of some medicinals, pharmaceuticals and special foodstuffs, etc., which may be masquerading under some trade or unpronouncable chemical name which does not convey to the user the patient, laborious and often brilliant research which has gone towards the production of the particular substance. Many examples can be found in literature. What do these weird names convey to the average user?

It should hardly be necessary to emphasise the effect of the complete removal of biochemistry and nutrition from the present Diploma course, for if this came into operation a student would leave without the slightest knowledge of the simplest aspects of the chemistry of the blood, excretions, secretions, vitamins, nutrition, etc., etc., and once in contact with some really difficult diagnostic problem, involving, say, a nutritional deficiency, he or she would have very little inkling as to how to proceed next. I do not intend you to think that I am advocating that all veterinary surgeons should be complete walking biochemical laboratories, far from it, but it is my contention that an elementary knowledge is essential for a proper understanding of any animal function, whether normal or pathological.

If sole reliance is placed on rule of thumb, precedent or even the label on the bottle, dangerous consequences are likely to follow, and it is therefore advisable to have some idea of the underlying processes at work. I feel that I have absorbed a good deal of my allotted time and your patience in emphasising the above aspects, but it seemed that a review of what biochemistry consists of and what goes to make up that curious race of people—the biochemists—would serve as a useful background for my selected examples of practical aids. And, furthermore, one must remember that the Diploma course is the link between the student and the written word.

I now intend to pass to my two main illustrative themes. First, *nutrition and deficiencies*. Probably one of the most fundamental contributions was the demonstration of the vitamin content and value of cow's milk in the nutrition of young animals made at the beginning of the century by the late Sir Frederick Gowland Hopkins, Professor of Biochemistry at Cambridge University. This work has since been expanded until we now have at our disposal a vast store of information on the function and distribution in Nature of these interesting substances, most of which are available on the market in an analytically pure and, therefore, most active form. Certain other aspects of nutrition have been established by historical usage; for example, everyone is familiar with the fact that although proteinaceous in nature, hair, hoofs and horns are quite undigestible and useless to the animal as a source of nitrogen. However, it is only in recent years that any really accurate attempt has been made to evaluate the detailed nutritional value of all the dietary proteins and their constituent parts, the amino-acids, but by degrees information accumulates on the exact requirements for the animal, and although we may only see simple and straightforward ration tables, yet it is due to brilliant researches that this simple guide is available.

In particular we have to thank the various American biochemical schools, such as those of Drs. Rose and du Vigneaud, for their many contributions in this field.

Turning to the inorganic side, many examples could be given, but I have picked only a few at random as being illustrative of practical valuable contribution, *e.g.*, Mellanby's work on rickets in dogs and other species, with the discovery that unless phosphate is in a readily available (inorganic) form it is not utilisable by the animal; Elvehjem's discovery of the importance of traces of copper when administering iron in the treatment of nutritional anaemia, and the many workers who have and who are investigating the effect of cobalt deficiency on farm animals. Before leaving these few rather sketchy illustrations I feel that I should make reference to two interrelated points; first of all, nutritional deficiencies and their symptoms are very relative, in so far that an animal may exhibit obvious signs as the result of a gross deficiency, yet if it is receiving just a sub-minimal amount of the particular substance, it may well be just below par, and will exhibit no characteristic symptom. This can, of course, be very puzzling to the most experienced and skilled diagnostician. In connection with this there is my second point, namely, that there is a good deal of research going on, which, although it appears to be without practical application yet is likely to be of great value. I refer to all present work aimed at getting a clear picture of precise signs and symptoms exhibited by an animal when on a diet with carefully controlled deficiencies ; this applies in particular to trace elements, some minerals such as sodium and potassium salts, and the vitamins. The results, if not exact pictures of what *may* be encountered in Nature, should serve as a very valuable " reference library " to all concerned.

As my second main theme I have chosen that of the study of *antibiotics and the related aspects of microbiological nutrition*. The discovery of penicillin by Sir Alexander Fleming opened up this particular field of endeavour, and the importance attached to this discovery was so great that a concentrated international effort on the parts of Great Britain and the U.S.A. resulted, during World War II, in the undertaking of an enormous programme of work resulting in the elucidation of the structure, properties and synthesis of this immensely important substance. The chemical and biochemical aspects were directed by three of the foremost chemists and biochemists

in the country; by Sir Robert Robinson, President of the Royal Society, Sir Ian Heilbron, eminent for his work on sterols (in particular vitamin D) and the carotenes (vitamin A), and Dr. E. Chain. I need not impress upon you the importance of this work, but it is only fair to add that it was made a great deal easier by the long and little-known researches carried out on the search for organic constituents of biological value in hundreds of microflora and fungi by the Biochemical and Microbiological staffs of the London School of Tropical Medicine and Hygiene. The work on penicillin and that newer antibiotic, streptomycin, proceeds apace together with the parallel studies of the nutritional requirements and metabolism of the host of unwanted bacterial parasites that inhabit the animal organism. Antibiotics are distinct from ordinary poisons in so far that they are more specific and would appear to be practically non-toxic to the host, a distinct advantage over, say, mercurials and arsenicals and even the more modern "sulpha" drugs.

Biochemistry is fast leaving the Cinderella stage of its evolution, for it is now recognised as a separate discipline in most institutions of scientific learning That it will go on expanding and increasing in importance is quite clear but what other disciplines will be born of it cannot be forecast. That it will continue to give assistance to the two great professions of human and veterinary medicine I have not the slightest doubt, but this will only be possible if the fullest mutual recognition and co-operation are maintained to the total exclusion of all prejudice. The elements of biochemistry should continue to be instilled into would-be practising veterinary surgeons adequately but not excessively, and there should be wider and more comprehensive programmes of co-ordinated research into both long- and short-range problems.

One of the main problems with a subject like biochemistry is to keep abreast of its progress; this, I am sure is somewhat of a worry to those in practice, who have little time for perusal of an extensive literature. It would seem reasonable to suggest that the occasional hour's lecture of the "Recent Advances" type would be of some assistance, in so far that much more can be said to much greater effect than by endless reading. And, of course, it need not stop at biochemistry.

May I, in conclusion, offer you my sincere thanks for listening so patiently to me. It is very difficult to be objectively impartial about one's own subject, and if I have fallen from grace in this respect I would ask your pardon.

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General Discussion

Mr. T. L. Wright: The poisoning of poultry by salt brought to his mind a case, many years ago, in which a number of ducks at a convent were suddenly seized with acute illness, followed by death which occurred rapidly—in some cases while they were floating on the pond. The symptoms were severe vomiting with violent quacking. Analysis showed that they all died from the effects of an overdose of tartaric acid. Enquiries were made, and it was found that a bazaar had been held and that one large cake was not popular and had been thrown away in the kitchen waste and given to the ducks. The conclusion was that someone had put too much baking powder in the cake, the ducks had eaten it and that it had been responsible for their deaths. Dr. Harvey had mentioned deficiencies including the deficiency of the trace element cobalt A year or two ago he read an abstract in *The Veterinary Record* on research work on strongylosis in cattle which showed that treatment with phenothiazine produced some improvement. Blood samples were taken, examination of which revealed that a large number suffered from deficiency of cobalt. With the administration of a small amount of cobalt, treated animals showed a marked improvement. He had tried it out on the horse for strongyloids. Although he had not taken blood tests he was convinced that the combination of a small amount of cobalt with phenothiazine had had a markedly beneficial effect. He had used approximately the strength mentioned in the article, *viz.*, ½ oz. of cobalt sulphate in half a gallon of water, each animal getting about 1 oz. daily mixed up with a small damp feed. He was convinced that it was a great help.

Miss Urabov: She had hoped that Mr. Orr would have given them more on the doping of greyhounds. One of the most important factors was the time factor in the rate of absorption. A certain amount of information could be gained by the examination of the greyhounds immediately before each race; they could and did eliminate the obvious cases of doping. She did not mean a complete examination of each dog, but they could make it jump a hurdle, trot round, and examine the eyes. If they did that before each race they had some sort of safeguard. She would like to know if Mr. Orr had any experience of the examination of saliva either in the doping of greyhounds or horses; one read a certain amount but the whole thing was rather vague. On the question of rat poison among poultry she would like to know what would be the tolerance dose on ordinary ground bait. Dr. Harvey's paper was stimulating and a reminder of the type of things one ought to read but for which one did not have the time. Did Mr. Harvey consider that biochemistry was a subject which should be freshened up in the final year of the student? When taught early in the curriculum it was possible that the student would take it as a subject to get through, but by the time he qualified he had forgotten a certain amount, and by the time he was a practitioner it would be an excellent thing to have the subject rubbed up.

Mr. Harvey Clarke: He would like to know if Dr. Harvey knew of any biochemical test for pancreatic deficiency in dogs and if such a test was known to the biochemist, was there any means of differentiating pancreatic from bile deficiency in dogs?

Dr. Hopkirk: He remembered the time when they could not get chemical work on pastures carried out in New Zealand; now the Animal Research Service had its own laboratory with about six chemists, a toxicologist and veterinary surgeons interested in nutrition and engaging in biochemistry. Even now they could not get a great deal of the work carried out by the biochemist as techniques were not yet known and there was insufficient knowledge to get the finer work performed. In facial eczema they had been six years looking for the toxin in flush growing ryegrass; first the laboratory could not get material owing to poor seasons for flush growth, and then the toxic metabolites disappeared before the grass was received by the chemist. The experimentalists had to wait for the chemist to give them the crystalline pure material for further experimental work. In the deficiency of cobalt and copper they claimed they were the first to recognise cobalt deficiency as a disease of stock, although they did not find the actual cobalt first. He joined issue with Dr. Harvey in his statement that natural foods were not deficient in some minerals and elements. Cobalt and copper deficient pastures grew quite naturally as a palatable food for stock in various areas of New Zealand, quite as naturally as the trees which had taken the mineral requirement from the deeper soils which were not deficient. On the question of salt poisoning, a lot of work had been done, but frequently they had not been able to produce salt poisoning by feeding large concentrated quantities, and he thought probably it was something to do with the strength of the solution. Salt poisoning was often to be seen among calves and pigs where they had access to salt, and especially whey from cheese factories where whey from pressed cheese had a high salt content when analysed. They had seen quite a number of poisonings under such conditions. They employed a toxicologist at the laboratory and he was one of the most valuable members of the staff in assisting practitioners who had to contend with so many cases of poisoning. They had found that lead poisoning was common, but before they had the toxicologist it had often been unrecognised *post-mortem*.

Miss Freak: With reference to a query on metaldehyde slug baits (raised by Miss Welch) she had herself taken up with the makers of one brand labelled "metaldehyde base non-poisonous" the question of danger to children, young animals and poultry, and could get no satisfaction in reply. They were under no legal obligation to label it a poison. Most reputable firms, however, now did so, and she suggested that it should be placed under cover.

Mr. Orr had emphasised the influence of natural disease on the effect of poisons. Could she take up another aspect of the problem and ask if the biochemist could help the clinician in regard to the effect of disease on the absorption metabolism and requirements of nutritional substances?

What, for example, was the true aetiology of the enamel-deficient, so-called distemper teeth in puppies? They were not specific to distemper but were they the effect of disease on calcium-vitamin D metabolism on absorption and, if so, could the parenteral route of administration be used during puppy illness with any hope of

preventing the condition? On the question of drug resistance to penicillin or other antibiotics, was it solely a question of acquired tolerance by the germ, or was it that by slowly wiping out susceptible species we were upsetting a natural balance and allowing less vigorous but non-susceptible species to increase?

Mr. Hudson: He could not agree that deficiency diseases were difficult to diagnose. In a new country, or when dealing with a newly discovered condition, there might be some difficulty, but once it was known that a deficiency disease occurred in a certain area or near that area, diagnosis usually was easy. An interesting point had been raised about the occurrence of deficiency diseases under natural conditions. One must be careful about the use of the expression "natural conditions." Wild animals in a free state were under natural conditions, but wild or domestic animals running out in a fenced area were not, even if the area enclosed by the fence was natural pasture. In parts of Kenya where "nakuruitis" (cobalt deficiency) occurred, one might expect to find the disease in ruminant game. Such animals, however, did not live continuously in the affected area. At certain seasons they migrated and, being free to leave the area, no doubt did so before a deficiency developed. He would cite a further example of poisoning occurring along with another disease. A pure-bred, imported bull died under circumstances suggestive of arsenical poisoning. Analysis of a sample of stomach contents revealed a relatively high concentration of arsenic. In order to satisfy disease-control regulations a gland smear was sent for examination. This showed that the animal was suffering from East Coast fever. He would like to ask for information on glycosuria in dogs. Was this condition common in England? He had seen only one case, an Alsatian bitch which, for no apparent reason, did badly and was found to have a high percentage of glucose in the urine.

Mr. Bywater: If Dr. Harvey were a biochemist and had a certain amount of time for research, apart from teaching, he could give him a few problems to elucidate. He did not know the fine differences between chemistry, biochemistry and toxicology and where one started and the others finished. He would like to refer to certain of the drugs. They knew that large doses—say 20 ml.—of carbon tetrachloride normally could be given to sheep, but if one gave 1 ml. to some sheep they would die. They knew that it might be bound up with the type of food the sheep were getting, but it was a fact that in a great many cases the diseased sheep lived and the fat sheep which did not require treatment were the ones that died. He would suggest that it connected with the fats in the body, and in the fat animal the drug had some deleterious effect. A substance manufactured by May and Baker (Anthiomaline) had been used in the tropics in human beings for certain diseases and in Zebu cattle for nasal granuloma, and it now was yielding spectacular results in some parts of this country in the treatment of husk, but in other parts it was absolutely useless. The animal in which it produced spectacular results was generally half starved, whilst animals in good nutrition often did not receive benefit from the drug. Occasionally there were nasty sloughs in cattle with 20 ml. doses (10 ml. intravenously and 10 ml. subcutaneously) and in cattle when the sloughs occurred the animal was fat; the poor half-starved animal did not get sloughs. The drug was an antimony compound and its unfortunate action was bound up with fat as was carbon tetrachloride. He thought Dr. Harvey should explore the changes which occurred when phenothiazine was acted upon by the digestive juices. Phenothiazine—as such—did not act on the parasite; it had to be absorbed in the blood stream and then secreted to affect the parasite. He did not know how much phenothiazine passed out of the body unchanged, but it was in the region of 90 per cent., and if one-tenth of a dose could be made to give the same results they could avoid the risk of phenothiazine poisoning. Why was it antimony salts such as pot. antim. tart. in powder form produced little effect on the animal body but had some adverse effect on parasites and in the horse it was one of the few agents of use for Ascaris infestation? Why was it that insoluble antimony salts had no marked effect on the animal while antimony in solution was an exceedingly poisonous and dangerous drug?

He remembered a case in which ducks died from HCN poisoning. The analysis of the water showed copper cyanide. The stream connected with a tidal river and inspection showed that algae and plants were missing up to a certain point well above a certain factory. The factory was discharging silver cyanide and copper sulphate, and although the analysis showed copper cyanide, due to interaction of the chemicals, it was a considerable help in tracing the source although the effect of the tide was misleading. He wished Dr. Harvey had been at the grassland conference, where details of the work of the clinician and biochemist were given. The analyses made by Green of blood supplied by Barker led to Barker's being able to differentiate calcium and magnesium deficiencies clinically by the symptoms alone. It showed the need for collaboration between the biochemist and the practitioner; deficiency diseases were not always what they seemed. In the old days doctors used to cure anaemia with crude iron preparations, but when refined drugs were used it was found that some copper was needed also. It was known that some of the "copper" and "iron" deficiencies might be mixed up with cobalt deficiencies. Indeed, pernicious anaemia appeared to be a cobalt problem. In answer to Miss Welch, a selected emetic would not act the same on all species of animals; if one put excessive salt in the rations of chickens it would kill them and if instead of ounces one put pounds in the rations of pigs it would act in exactly the same way.

Professor McCunn: Mr. Hopkirk's remark, where he mentioned lead poisoning but saw no symptoms in life and the *post-mortem* report was to the effect that there was no lead poisoning, was most confusing.

Dr. Hopkirk: A toxicologist analysed the stomach contents.

Professor McCunn: It showed that they could not always take notice of a toxicologist. If there were no clinical symptoms of lead poisoning and if at the *post-mortem* examination there was no sign of lead poisoning, it could not be lead poisoning. Some years ago he saw some greyhounds with what was believed to be haemorrhagic gastro-enteritis. Sir John M'Fadyean had a number of the dogs to examine but he could not give an explanation. It looked like an acute attack of Stuttgart. As there were new lead pipes and new aluminium vessels, Dr. Clough looked for lead and aluminium in the water and in the food and at first was of the opinion it was lead poisoning. They thought they hit on the secret but later it was found that grass in the neighbourhood contained lead, more lead than there was in the food. Later again the trouble was found not to be lead poisoning. If the animal showed clinical signs of lead poisoning and the toxicologist found lead at the *post-mortem* examination then they might suspect that an animal died of lead poisoning. In later years Dr. Clough almost came to say that there was no such thing as lead poisoning. Certainly he could say that a body could contain lead without danger in amounts previously considered lethal. Salt poisoning was also a debatable thing and he was a bit of a disbeliever in it. A few years ago there was a big legal case involving a seaside resort where a salt water bathing pool was periodically emptied into some ditches. A farmer lost some bullocks. He took action against the local council because according to the toxicologist salt was found in the bullocks. The pleadings were altered to state that the salt water in the ditches did not poison the cattle but that it was so distasteful that it deprived them of water and so they developed ill health and died. The case was fought on the principle that the salt deprived them of something that the animals had a right to and was necessary for their well-being. Mr. H. Clarke had mentioned pancreatic deficiency and asked about a test. If it was a bad case they could recognise it as soon as they walked into a room; there was a smell (in mild cases they could smell the end of the thermometer) of rancid fat. The fat was not broken down normally; literally it putrified. It was one of the common things which caused mild digestive disturbances—the deficiency of the normal digestive secretion from the pancreas—and it could be put right by giving the average dog from 4 to 8 g. dry pancreas in tablet form. The dogs appeared to pass out more than they ate and the faeces were not so solid.

Mr. Clarke: Were there the same conditions for bile deficiency?

Professor McCunn.—The bile duct was affected as well; most of the cases were the result of a catarrhal condition of the duct. If the condition of the bile was upset as well then the two things often went together.

Mr. Clarke.—Was the condition sufficiently acute to cause such pain that the animal cried out and turned its head towards its flank?

Professor McCunn: Yes, the "stretchy dog." They often got also the "praying dog" and in those cases it was well worth while putting the thermometer in the rectum and smelling to see whether it was a pancreas dysfunction. He instanced a dog which when given 4 g. pancreas did not "pray" but if it was stopped within three days the dog adopted a praying attitude again. He would like to ask Mr. Gourlay how much stilboestrol he gave [Mr. Gourlay 30,000 units, 12 ml.]. He had heard of similar trouble where people gave bigger doses: four or five times the amount recommended. As to calcium deficiency in dogs, he had heard talk of the greyhound which was defective in its vision, rocked on its legs each morning and yet was all right a few hours later. He was sure that condition was a calcium deficiency because if such a dog was given calcium, in a short time it would be walking about perfectly all right. In one instance out of seven ranges of kennels only one escaped. It was discovered afterwards that the trainer of the dogs in the latter kennel was the only one to give cod liver oil. With reference to diabetes in dogs, some

time ago on reading an American article he was surprised at the number of dogs which showed evidence of sugar in urine. Some things they gave dogs were insoluble and yet seemed to do them good. Graphite was used extensively in homeopathic medicines and it was used in veterinary practice as a remedy and a preventive for interdigital cysts. In many cases it worked, but chemists told them the graphite passed through the animal and was not absorbed.

Dr. Hopkirk: A large number of cases of poisoning of calves that he mentioned were due to licking paint; some were found sick and others were found dead. From the material analysed in the laboratory it was obvious that calves had died from lead poisoning although not showing lesions. At Weybridge, Dr. Ruth Allcroft was emphatic that a large number of animals with lead poisoning had no recognisable lesions until the chemist was able to get hold of the stomach contents and analyse them.

The Replies

Dr. Harvey, in reply to those who took part in the discussion, agreed that a refresher course in biochemistry in the final year would be of value and after that, five or six lectures to the practising veterinary surgeon.

On pancreatic deficiency in dogs, one method was to estimate the diastase activity of the urine, as in the animal with normally functioning pancreas diastase (amylase) was excreted in the urine. Examination of the faecal fat, however, was not always of value as a normal animal might excrete quantities of fat comparable to one suffering from pancreatic deficiency.

In replying to those speakers who had discussed "natural conditions" Dr. Harvey said that surely these allowed complete freedom of movement and would enable an animal to avoid, say for example, poisonous herbs or poor pasturage which under conditions of captivity they would find harder to avoid.

As regards glycosuria, he quoted an example of a "true" renal glycosuria in a young Alsatian puppy which showed signs of wasting, passed syrupy concentrated urine and exhibited extreme lassitude. He stated that cases of true diabetes mellitus in domestic animals, especially herbivores, seemed to be extremely rare and asked members for any further information.

In reply to the comment on graphite and sulphur absorption he said this was difficult to answer but suggested that as both these substances had an enormous area they would probably be able to absorb quite a quantity of toxic material.

In referring to cases of poisoning from unknown vegetable source in New Zealand Dr. Harvey suggested that the phytotoxin might possibly be protein in nature and referred to the substance ricin. He emphasised the need for much more research in this field of endeavour.

Mr. Oar, in reply, said that it was impossible to deal adequately with all the points raised in the discussion, some of which would afford sufficient material for a whole paper. He had not attempted to deal with doping in greyhounds in detail but had used it merely as one example of the use of a biochemical test. With regard to tests on the saliva for evidence of doping, he felt that too much was expected of this procedure: there was some evidence that cocaine was secreted selectively in the saliva, but he was not aware that this applied to many other drugs used. In the case of greyhounds samples of vomit and urine were more satisfactory materials for analysis. The danger to domestic animals of rat poisons was a serious one but he failed to see how it could be overcome by incorporating an emetic or an antidote in the bait as had been suggested; such a method would of course help to protect the rats. Some manufacturers of zinc phosphide baits stated that it was harmless to dogs and cats because it made them vomit, but he had had several clear cases of poisoning in these animals by this substance.

The subject of salt poisoning was a difficult one. Experimental animals usually refused heavily salted food, yet salt poisoning was well established. There were undoubtedly other factors involved, such as the management and the method of feeding, but we were still not clear as to the mechanism of the poisoning. The important subject of lead poisoning had been referred to, but he would confine himself to two observations prompted by Dr. McCunn's remarks: the fact that the classical symptoms were not seen did not exclude lead as the cause of death; it might mean that no one was present to observe the symptoms when they did occur. The *post-mortem* lesions varied but in his experience peri-renal haemorrhages were a much more constant finding than any changes in the alimentary tract. With regard to "aldehyde" poisoning he felt that the chief difficulty lay in the very rapid action of the poison; it was doubtful whether an antidote could be given quickly enough to be effective. The subject of glycosuria had been dealt with by Dr. Harvey; he might add that the condition was occasionally encountered in the routine examination of urines, and he was convinced that it was rarely due to true diabetes in the dog. He agreed with Dr. Harvey's remarks on the matter of solubility: the term was a relative one, an insoluble substance really being one that was only very slightly soluble: lead sulphate, for example, was insoluble, but it was sufficiently soluble to cause poisoning. Graphite, however, almost certainly owed its effects, not to any slight solubility but to its power of adsorbing toxins.

Further Discussion

Mr. Bywater.—The dose of phenothiazine in animals varied and the drug was utilised more in the horse than in cattle, due to the relatively larger surface of the intestine of the horse as compared with that of the ox or sheep.

Professor McCunn.—The surface area was the same.

Mr. Bywater.—It was larger in the horse and so the digestive juices acted longer.

Professor McCunn: With calcium deficiency there was a definite clinical picture. In dogs the animal would run along and knuckle over in front and the lower jaw would touch the ground and the dog appeared to shove itself up again. Later on the condition affected the hind legs and if uncontrolled the dog would become unable to rise and would lie on its side in a state of coma. When in that state one reflex was useful. If they tapped the side of the face the dog would blink. In cattle practice also they could produce this blink. If there was a little tremor after the blink it was wise to give calcium. Within ten to 15 minutes of putting in calcium the reflexes would be normal. He mentioned two cases of dogs where 20 c.c. of calcium were injected and within ten minutes the animals were walking. After injecting calcium he had known blood to be taken at half-hourly, two hourly and up to eight-hour intervals and in spite of the extra calcium in the blood stream no excess of calcium was shown when the assays were made—in a number of cases the amount was less than what was normally in the blood before the animals were injected.

Mr. Gourlay.—The blood held on to the calcium as long as possible.

Mr. Clarke: Would a gall stone in the act of passing through the bile duct account for symptoms as shown in the photograph of the praying dog?

Professor McCunn.—He thought so, but he had never seen a gall stone in a dog.

Mr. Gourlay.—He understood "blue eye" in non-distemper dogs was due to calcium deficiency.

Professor McCunn.—He would give calcium and cod liver oil and wash the eye with 1/7,000 sol. chloride of mercury, also instilling cod liver oil; the cod liver oil acted best if it was a little rancid. With corneal ulcer, if they gave cod liver oil internally it would clear up in three weeks.

Mr. Gourlay.—He understood that in "blue eye" homeopathic calcium had a quicker effect than by injection clinically: homeopathically 1,000th part of a grain was used as against 20 ml. of a 10 per cent. solution injected.

Mr. Bywater.—That amount of calcium given in cases of milk fever was ridiculously small when compared with the calcium present in the cow's body, but at the same time it did sometimes produce spectacular results.

COLONIAL PRODUCTS RESEARCH

In the course of the debate in the House of Lords on July 19th on the second reading of the Colonial Development and Welfare Bill, Lord Hankey, who is chairman of the Colonial Products Research Council, mentioned that recently a promising substitute for linseed oil had been discovered. From a West African weed, he said, a group of Liverpool scientists had produced a very valuable oil known as conophor oil, which had great promise. It had not been finally approved, and it must be remembered that because it was possible to produce an oil from weed it did not necessarily follow that that weed could be grown as a crop. That matter was being actively pursued under Colonial Office direction. There was also a promising rubber seed oil which would be a by-product of the rubber industry. This had been proved out scientifically—and more than scientifically proved out—like the conophor oil, by the skill of the user. Unfortunately, however, it had been held up in development by the unsettled conditions in Malaya. Some wonderful work had been done in sugar. It was extraordinary the promise that sugar research showed. The actual accomplishments varied from a substitute for blood plasma (which has been used up to 50 per cent. in certain hospitals) to anti-freeze mixture.

CLINICAL COMMUNICATION

PATENT FORAMEN OVALE IN A PUPPY

C. W. OTTAWAY

(Department of Zoology, Cambridge)

The puppy was examined in life by Mr. R. B. Comyn, M.R.C.V.S., of Eastbourne, who supplied the following details and clinical record.

"A 35-day-old bulldog bitch puppy was reported to be feeding well but otherwise not progressing. From time to time it seemed to be choked and gasped for breath with its mouth open, at which time its tongue and lips were seen to be blue. Temperature was normal.

On auscultation by stethoscope, it was evident that there was some gross valvular insufficiency, the normal heart sounds being completely absent and replaced by an irregular "shusshing" noise. A tentative diagnosis of patent foramen ovale was made. The puppy was destroyed by intra-peritoneal nembutal, so as to leave the thorax untouched."

Dissection findings revealed a perfectly normal cadaver apart from congestion of the venous system. The heart, lungs and great vessels were dissected free and perfused with formalin before opening. Detailed examination of these structures demonstrated an uncomplicated patency of the foramen ovale (see figures)—there being no other cardiac or pulmonary lesion. The ductus arteriosus was closed with the normal accompanying change of the aortic arch, although its outer circumference was still large.

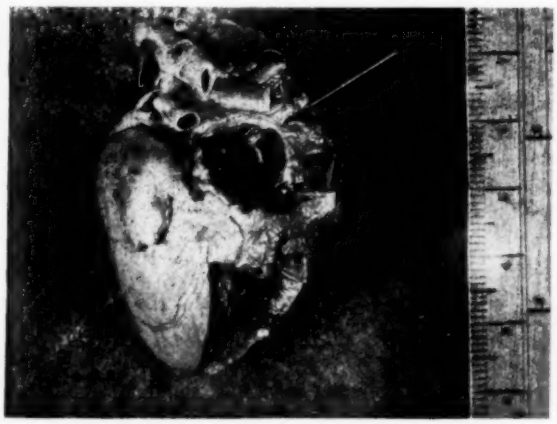

Figure 1.—Half-left caudal view of heart, part of roof of left atrium and wall of left ventricle removed. Note well-formed septum primum forming part of inter-atrial septum (beneath glass rod) and its free edge forming the lower half of the patent foramen. Note also the level of entry of the vein draining the cardiac lobe of the right lung, into which a glass rod is inserted, is below that of the aperture. The cut end of the aorta above the two pulmonary arteries, the right of which shows two branches, can be seen and also the forming ligamentum arteriosum connecting the aorta with the root of the pulmonary aorta. (Centimetre scale.)

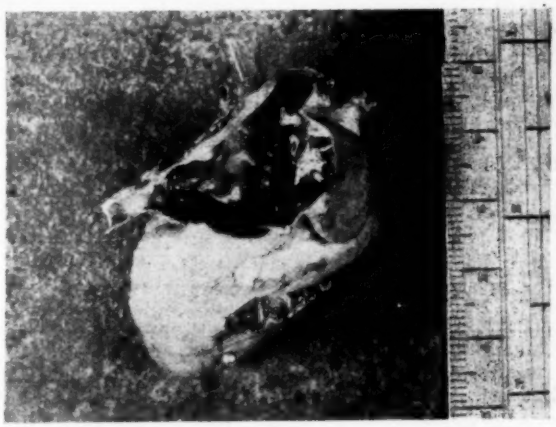

Figure 2.—Right lateral view of heart, roof of right atrium and part of wall of right ventricle removed and anterior and posterior vena cavae opened longitudinally. Note long and comparatively straight edge of the limbus fossae ovalis forming the cranial (anterior) rim of the still patent foramen. A glass rod is inserted into the azygos vein above the foramen and another into the coronary sinus entering the right atrium to the left of and below the level of the foramen. (Centimetre scale.)

Discussion

Although the foramen ovale in the dog is often completely sealed at one month *post-partum*, it is by no means uncommon to find a patency at this age, or even well into adult life, which has apparently caused little inconvenience to the animal except, possibly, at moments of great exertion. Provided the flap-valve of the foramen covers the aperture, transseptal flow is prevented, physiological requirements are satisfied and normal heart working is possible. The clinical history of this case suggested that this was not so and examination confirmed that, in fact, the valve did not completely cover the aperture.

As to the cause of the defect, the answer is not quite so clear. Our conception of the closure of the foramen in animals possessed of a simple flap-like valve is generally based on the condition as seen in man and the pig. In the embryo pig (Patten, 1931) the two atria are first partially separated by a crescentic septum primum which grows from the cranial wall of the atrium towards the endo-cardial cushions—which divide the atrio-ventricular canal into right and left channels. The space between the edge of this septum and the cushion is known as inter-atrial foramen I. Just when it would appear that the septum is about to fuse with the cushions and so separate the two atria completely, a break in the cranial portion of the septum occurs, which is known as inter-atrial foramen II. At about this time the septum secundum appears to the right of the septum primum. Also crescentic, it fuses with the septum primum in the vicinity of the endocardial cushions. Its growth, however, is not uniform: an opening remains in its centre—the foramen ovale. The foramen ovale is thus associated with growth of the septum secundum, and is so situated that in the foetal state it is covered by, but not united to, the portion of the septum primum caudal to inter-atrial foramen II, now in the form of a flap-valve with its free edge facing dorso-cranially. In post-natal life, the valve of the septum primum is bound to, and forms part of, the inter-atrial septum, the inter-atrial foramen II is obliterated and the foramen ovale becomes the fossa ovalis with a gradual reduction in size, although the

cranial rim of the fossa—Franklin's *crista dividens* of the foetus—always persists as a well-marked structure in the right atrium of the adult termed the *limbus fossae ovalis*.

Patency of the foramen ovale, then, of the type which will not allow of functional closure, can be attributed to irregular growth ot either of the two septa. In the case under review there would appear to be nothing wrong with the septum primum. As seen in figure 1 it is a well-formed part of the inter-atrial septum and its free edge, forming the lower half of the observed aperture, is at a level which normally would cover the foramen ovale as judged from the level of entry of the pulmonary veins draining the apical and cardiac lobes of the right lung (into one of which a glass rod is inserted) which normally enter the left atrium at the level of the foramen. It is more likely that defective growth occurred in septum secundum resulting in an excessively large foramen ovale. As seen in figure 2 the limbus fossae ovalis is long, has a comparatively straight edge and is at a somewhat more cranial level than usual in relation to the caval openings.

However that may be, the point at issue is that in cases of uncomplicated patent foramen ovale *associated with clinical symptoms of dyspnoea*, the cause of the trouble can be looked for as incomplete anatomical occlusion *accompanied by inability of functional closure*—and this in turn to be due to defective growth of one or both of the foetal inter-atrial septa, whereas in cases of patent foramen ovale not associated with clinical symptoms it is usually found that functional closure is possible. The same condition obtains, *i.e.*, possibility of functional closure, in cases of thoracic disturbance, mostly in young animals, when some other lesion, often developmental, is also present; but in these cases it can be assumed that the complicating lesion is responsible for the failure of subsequent anatomical occlusion.

REFERENCE

PATTEN, B. M. (1931.) The Embryology of the Pig. 2nd Ed. Philadelphia: Blakiston Co.

QUESTIONS AND ANSWERS

The submission of questions for inclusion in this column will be welcomed; they can relate to any aspect of veterinary work. For purposes of record, each question is numbered, and those submitting questions are required to furnish (not for publication) name and address.

Answers to readers' queries represent exclusively the personal opinions of the writers, and criticism of the replies will be appreciated.

All communications should be addressed to the Editor.

Genetic Origin of Hermaphroditism

Q. 317.—*In cases of hermaphroditism is the condition due to a recessive inherited factor, or is it invariably due to some accidental juxtaposition of the differently sexed foetuses* in utero?

A.—Hermaphroditism is not always connected with foetuses of different sexes, as the latter part of the question would seem to imply.

A simplified classification of the various types of hermaphroditism is as follows:—

(*a*) *True Hermaphroditism.*—Ovarian and testicular tissue present in same individual; internal genitalia are faultily bisexual and external genitalia show mixed male and female characteristics.

(*b*) *Pseudo-hermaphroditism.*—The sex glands are either male or female but the external genitalia tend to be of the opposite sex; the internal genitalia may be of either sex or mixed.

The Bovine Freemartin—a genetic female born twin to a male—apparently belongs to the pseudo-hermaphrodite category. This condition is brought about by the fusing of the foetal membranes of the differently sexed twins, with interchange of blood between the developing foetuses. The male gonad develops first and its secretions influence the female gonad and genitalia, with consequent imperfect development. External abnormalities of the freemartin are not clearly apparent, usually only the poorly developed mammary tissue and enlarged clitoris being noticeable.

Inheritance.—It is difficult to say to what extent hermaphroditism is inheritable among mammals in general. In the goat there is quite reliable evidence for believing that genetic factors are causally involved, but further study is needed to establish the mode of transmission, at least so far as British goats are concerned. Eaton & Simmons (*J. Hered.* **30.** 261 (1939)) from a fairly comprehensive study of the U.S. Department of Agriculture's goat herds, reached the provisional conclusion that the condition as met with in those herds was due to a single recessive gene. Crew (*Proc. R. Soc.*, Series B. **95.** 90 (1925)) had previously likewise concluded that a type of hermaphroditism was hereditary in British goats, and that it was due to a recessive gene present in the homozygous condition.

There is also a possibility that the genes for hermaphroditism and for hornlessness in goats may be linked (Asdell; *Science.* **99.** 124 (1944)).

The freemartin type of hermaphroditism as met with in cattle is developmental in origin; genetic factors are involved only in so far as the tendency to produce twins may be concerned.

. . . . .

Identification of Lambs by Blood Examination

Q. 318.—*Arising out of a dispute concerning the ownership of a lamb, I have been asked if it is possible to establish conclusively by blood examination or otherwise the relationship between a lamb and its alleged mother.*

Can you say please if this is possible and, if so, how it is done?

A.—To establish conclusively the relationship between a lamb and its mother within a breed is a matter of great difficulty. Apart from physical characteristics, blood examination for the presence of certain red blood cell antigens seems the most suitable method. This method has been developed successfully to determine parentage in cattle, but the technical difficulties are greater than in man. While the method used for bovine blood (Ferguson, *J. Immunol.* (1941)) might be applicable to sheep, there is but little information available regarding sheep's blood; the successful application of the method to sheep might be possible, but it is likely to require considerable research.

Very recent work, *e.g.*, Ycas, *J. Immunol.* April. (1949), has demonstrated at least nine types of independent cellular antigens in sheep's blood; they are assumed to be controlled by genes and to be dominant hereditarily. However, the necessary genetic data to prove these assumptions are not yet available and hence demonstration of the presence or absence of these antigens in a ewe and lamb would not constitute sufficient proof of parentage in the light of our existing knowledge.

. . . . .

Treatment of Chorea in Dogs

Q. 319.—*Since I retired 23 years ago (when the treatment of chorea in dogs was almost hopeless) have any new methods of treatment produced more promising results?*

A.—Chorea in dogs occurring during or following virus

disease still comes within the category of those conditions for which there is a multitude of remedies but no cure, and severe generalised chorea is usually a prelude to a fatal termination.

In the mild localised case, however, in the absence of other evidence of nerve tissue damage, the condition may be to some extent self limiting and likely to lessen slowly over a long period as general health improves.

It is very noticeable in such cases that any factor lowering resistance, *e.g.*, fatigue, cold, intercurrent illness, pregnancy, etc., is liable greatly to accentuate the chorea and treatment is directed mainly towards the avoidance of such factors and the provision of an adequate convalescence.

Sedatives are of value only when chorea is sufficiently severe to interfere with rest, and they are generally confined to the milder agents, *e.g.*, bromides, soluble phenytoin, aspirin, etc.

Attention should be paid to the possibility of a Ca-P imbalance (possibly Mg in addition) and if present it should be corrected by the use of Ca borogluconate plus Tonophospham by injection or Ca lactate and glycerophosphates by mouth, or magnesium lactate by intramuscular injection or by mouth.

Exhibition of the vitamin B complex during convalescence by whole liver extract injection or " Befontiss," or given by mouth in one of the many proprietary forms or as brewer's yeast, may be helpful.

Exhibition of vitamin E (Vogt Muller, 1942) has been claimed to reduce the incidence of chorea if given throughout illness.

Other empirical medications which have occasionally given good results include :—

(1) Organic arsenicals, preferably by injection.

(2) Various hormone combinations, *e.g.*, thyroid-pituitary-ovarian-orchitic or thyroid-parathyroid and Ca lactate.

(3) Nerve stimulants, *e.g.*, strychnine, Easton's syrup, etc.

REFERENCE

VOGT MULLER P. (1942.) *Tierärztl Rundschau.* **48.** 274.

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CORRESPONDENCE

Breed Suitability for Batteries

Sir,—At the B.O.C.M. Poultry Demonstration Farm, Stoke Mandeville, we have had 27 pure breeds and cross breeds under test during the past three years, involving some 3,000 laying stock housed in hen battery cages. It is our experience that the light-heavy cross gives the best egg production, and the light breeds the worst. Furthermore, the increase in bodyweight after 48 weeks in such cages has averaged 1·42 lb. for the light-heavy crosses and 0·9 lb. for the light breeds. The value of, for example, a Black Leghorn x Rhode Island Red in the hen battery system can be seen from our last year's average egg output, *i.e.*, Black Leghorn 166, Rhode Island Red 174, and light-heavy crosses 185. This cross is also economical where food consumption is concerned with an average of 5·7 oz. per day (pellets) compared with 5·9 oz. of the Rhode Island Red.

This information may be of some value to your readers concerned with question CCCXVI of July 16th.

Yours faithfully,

W. P. BLOUNT.

The British Oil & Cake Mills, Ltd.,
Poultry Advisory Service,
2, Kingscote Street, London, E.C.4.
July 26th, 1949.

WEEKLY WISDOM

". . . The young are preoccupied with the most important things—philosophy, religion, love. That is why on the whole I respect them more than the old or middle-aged, and why I think them really wiser—more fit to become so if you like to put it that way—though they may be often greater fools. Later on such questing becomes transmuted into a more or less passive process of getting used to things, and the passions, if not informed with imagination, are apt to be rather meanly accommodated. But as long as anything worthy to be called 'Youth' persists, so long hope remains, whether rebellious or wistful, that something admirable, not to say astonishing, can be made out of the mixed stuff, each feels himself or herself, and Life itself to be . . ."—DESMOND MACCARTHY, Meredith and Youth. (*The Sunday Times*, September 26th, 1948.)

ABSTRACTS

[Recent Pharmaceutical Advances Applicable to Veterinary Medicine. DAVIDSON, J. LAVERE. (1949.) *N. Amer. Vet.* **30.** 160-166]

The rapid advent of new pharmaceutical substances into practical medicine has created a problem of dosage, particularly for the veterinarian. The danger of underdosage with new anti-biotics is very real.

Folic acid is worth more consideration as an adjunct to diet. As a growth-promoting factor in the dog it may be given in doses of 1-3 mgm. daily by intramuscular or oral route. Of the new antihistamine group based on phenolic esters the best known are probably benadryl, pryibenzamine and pyrrolazote, though the number increases rapidly. Gelatin solution obtained from bone is an efficient substitute for plasma in emergency, but is contraindicated in nephritis. The dosage is 7-15 c.c. per lb. by slow intravenous route. The dosage of protein hydrolysate varies ; at a strength of five per cent. an intravenous dose of 50-250 c.c. is recommended for severe negative nitrogen balance in the dog.

Bacitracin, obtained from an aerobic, Gram-positive spore-forming bacillus, is a substitute for penicillin. There appears to be no sensitivity to the product. The recommended dosage approximates closely to that of penicillin.

J. P.

* * * *

[An Experimental Basis for Amino-acid Therapy in Canine Practice. SIEGMUND, O. H., & MORRISON, E. J. (1949.) *J. Amer. vet. med. Ass.* **114.** 154-157.]

The value of a protein hydrolysate in re-establishing a positive nitrogen balance lies in the ready availability of its nitrogen. This value becomes relatively greater in the depleted subject as against the normal one (Seeley, 1945).

The authors fed five normal adult female dogs with six per cent. casein hydrolysate in addition to a protein-free diet. Subsequently three more animals similarly were tested with a 15 per cent. casein hydrolysate fortified with tryptophane. They showed that by whatever route the hydrolysate was administered and irrespective of speed, there were practically no untoward reactions; that 110 mg. of nitrogen per kg. of body weight was the minimal intake for the maintenance of a positive nitrogen balance, and that protein hydrolysate therapy is of considerable value to the small-animal practitioner.

J. P.

HISTOLOGICAL STUDIES OF THE LIVER IN HYPERTHYROIDISM

Mr. M. Maqsood, of the School of Agriculture, University of Cambridge, writes: "Groups of young male mice were fed with thyroprotein (containing 2·8 per cent. d,l-thyroxine) in concentrations from 0·025 to 0·1 per cent. of the feed for a period of four weeks at an environmental temperature of 24 to 30° C., at the Physiological Laboratory, Michigan State College, East Lansing, U.S.A., while the writer was working there during the year 1948-49. All the mice were weighed weekly and after the experimental period the mice were killed. Macro- and microscopic examinations of the livers of thyroxine-treated mice did not reveal any pathological changes. However, a number of neutrophils were seen in the hepatic sinusoids. It may be suggested that when thyroxine is administered to the mouse within *physiological range* it does not cause any pathological changes in the liver."

NOTES AND NEWS

Diary of Events

Aug. 12th to 15th.—Sixty-seventh Annual General Meeting and Congress, N.V.M.A., in London.

Aug. 13th.—Annual General Meeting of the Ladies' Guild, Victoria Veterinary Benevolent Fund, at the Royal Veterinary College, N.W.1, 10.30 a.m.

August 13th.—Fourteenth Annual Meeting of the Royal (Dick) Veterinary College Alumnus Association, at the Café Anglais, 20-21, Leicester Square, London, W.C.2, 1 p.m.

Aug. 15th.—Annual Meeting of the Association of Veterinary Teachers and Research Workers, Royal Veterinary College, N.W.1, 2 p.m.

Aug. 25th.—Summer Meeting of the Eastern Counties Division, N.V.M.A., at Great Yarmouth, commencing at noon (see Notice).

Sept. 7th.—Meeting of the Southern Counties Division, N.V.M.A., at Salisbury, 6 p.m.

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CONDITIONS OF EMPLOYMENT OF YOUNG GRADUATES

We would draw the attention of intending advertisers in our " Appointments Vacant " column to the request made therein that the salary or salary range offered be stated in their announcements. This request is made in order that the Home Appointments Committee may acquire the evidence requisite for their consideration of the conditions of employment of young graduates, an enquiry in which the Committee is being seriously handicapped by the disappointing response met with hitherto. If, despite the Committee's appeal, any members are not prepared to respond through the medium of their advertisements they are urged, nevertheless, to make the desired information available by advising the Editor of the terms of remuneration offered.

* * * * *

PERSONAL

Marriage.—Cross—Crow.—On August 6th, 1949, at St. Martin's, Barnehurst, Kent, Barry A. Cross, B.A., B.SC., M.R.C.V.S., second son of Mr. and Mrs. H. C. Cross, of Worthing, Sussex, to Audrey Lilian, elder daughter of Mr. and Mrs. V. Crow, of Barnehurst.

. . . . . .

Mr. J. K. L. Pearson's Doctorate.—Mr. J. K. L. Pearson, B.SC., M.R.C.V.S., of the Veterinary Research Division, Ministry of Agriculture for Northern Ireland, Hon. Secretary of the North of Ireland Division, N.V.M.A., has been successful in obtaining his Doctorate in Philosophy in the Queen's University, Belfast. The title of his thesis was "Bovine Mastitis in Northern Ireland with particular reference to *C. pyogenes* Mastitis in dry cattle and *C. pyogenes* infection."

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National Agricultural Advisory Service.—Mr. William Williams, M.SC., B.SC. (AGRIC.), County Agricultural Officer for Devonshire, has been appointed Deputy Director, Wales. Mr. Williams will take up duty at Cardiff on August 15th, 1949.

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THE LATE MR. WALTER GARDNER, M.R.C.V.S.

Mr. Walter Gardner, M.R.C.V.S., of Woodside, Maybole, Ayrshire, whose death a fortnight after that of his wife we recorded with deep regret in our issue of July 30th, was the eldest son of Mr. Duncan M'Naught Gardner, M.R.C.V.S., veterinary inspector for East Dunbartonshire. He graduated with distinction at Glasgow Veterinary College in 1904, having gained several first-class certificates during his College career, and the H. & A. S. certificate for final year students. After graduating he was assistant to a veterinary surgeon in Castle-Douglas for five years, and in 1909 he secured an appointment with the Lanark County Council under the late Mr. Hugh Begg. In 1914 he joined the Army Veterinary Corps, and on leaving the Army he set up in practice in Maybole, where he remained until his death, carrying on an extensive practice among the dairy herds of the South-West of Scotland.

Apart from professional activities, Mr. Gardner took a very keen interest in Clydesdale horses and was specially interested in pedigrees, show records, and longevity of the breed. For a number of years he was secretary of the Monkland and Minishant Foal Show.

Mr. Gardner is survived by one son—Mr. W. J. F. Gardner, who is a livestock inspector with the Department of Agriculture and now stationed in Ayr—and two daughters. There was a large and representative attendance at the funeral which took place at Maybole cemetery on July 23rd.

* * * *

N.V.M.A. Pension and Family Provision Scheme

We quote the following recent instance as a demonstration of the advantages of this scheme to the dependants of our members:—

In return for total contributions of £108 7s. 6d. paid by one of our deceased members, the widow in this case received a payment of £1,361 18s. A capital sum was paid as the widow had just emigrated overseas, although she was actually entitled to an income benefit of £50 per annum for 30 years, and a cash sum of £500 at the end of that period.

The Family Provision element is as valuable as the highly satisfactory terms upon which Members' Pension Benefits have been based, and we are glad to know that a steady stream of enquiries is received from members all over the country by the Association's Insurance Brokers for the scheme, Messrs. Walter Herriot & Co., Ltd., of Lloyd's Building, London, E.C.3.

* * * *

Tuberculosis (Attested Herds) Scheme

STATEMENT SHOWING POSITION OF "ATTESTED HERDS" IN EACH COUNTY AS AT JUNE 30TH, 1949

County	Total Cattle as at 4.6.48	Number of Attested Herds as at 30.6.49	Number of Cattle in Attested Herds as at 30.6.49	Percentage of Attested Cattle to Total Cattle
Bedford	44,808	82	4,840	10·8
Berks	81,151	430	23,370	28·8
Buckingham	107,354	206	14,350	13·4
Cambridge	29,655	86	4,820	16·2
Isle of Ely	19,638	25	1,140	5·8
Chester	238,541	455	22,850	9·6
Cornwall	259,545	375	13,490	5·2
Isles of Scilly	499	89	480	96·2
Cumberland	217,354	1,392	60,380	27·7
Derby	179,730	231	12,090	6·7
Devon	396,478	628	25,890	6·5
Dorset	144,236	604	33,110	23·0
Durham	112,818	371	14,590	12·9
Essex	121,985	493	24,130	19·6
Gloucester	182,900	460	24,980	13·6
Hampshire	139,813	698	33,260	23·8
Isle of Wight	20,103	71	3,040	15·1
Hereford	131,445	258	13,590	10·3
Hertford	57,650	237	14,450	25·1
Huntingdon	27,586	33	2,160	7·8
Kent	117,868	383	18,350	15·6
Lancaster	271,835	592	24,810	9·1
Leicester	154,562	168	9,130	5·9
Lincoln (Holland)	24,931	1	10	—
Lincoln (Kesteven)	65,025	26	1,140	1·8
Lincoln (Lindsey)	150,565	59	2,780	1·8
London	84	—	—	—
Middlesex	7,534	26	1,450	19·3
Norfolk	164,648	352	24,200	14·7
Northampton	143,457	105	6,650	4·4
Soke of Peterborough	7,117	1 5	6,650	4·4
Northumberland	199,041	293	15,830	8·0
Nottingham	104,787	122	5,520	5·3
Oxford	99,661	468	24,380	24·5
Rutland	19,280	13	680	3·5
Salop	269,339	469	28,070	10·4
Somerset	309,568	849	43,460	14·0
Stafford	229,962	216	10,430	4·5
Suffolk, East	72,704	174	9,100	12·5
Suffolk, West	35,207	125	7,890	22·4
Surrey	50,092	321	14,440	28·8
Sussex, East	105,381	366	14,900	14·1
Sussex, West	70,440	296	14,100	20·0
Warwick	142,926	230	12,990	9·1
Westmorland	93,596	1,004	41,780	44·5
Wilts	186,714	433	29,250	15·7
Worcester	96,477	154	8,040	8·3
Yorks, East Riding	123,914	57	2,150	1·7
Yorks, North Riding	236,791	605	22,280	9·4
Yorks, West Riding	333,552	821	29,670	8·9
ENGLAND	6,490,347	15,922	770,360	12·0

County	Total Cattle as at 4.6.48	Number of Attested Herds as at 30.6.49	Number of Cattle in Attested Herds as at 30.6.49	Percentage of Attested Cattle to Total Cattle
Anglesey	56,187	97	3,460	6·2
Brecon	46,035	159	5,670	12·3
Caernarvon	61,143	188	6,180	9·9
Cardigan	73,431	3,704	56,200	76·5
Carmarthen	130,013	4,837	92,720	71·3
Denbigh	100,807	542	14,800	14·7
Flint	60,297	105	4,300	7·1
Glamorgan	72,992	199	5,600	7·7
Merioneth	41,655	957	18,490	44·5
Monmouth	67,285	166	6,770	10·0
Montgomery	94,918	412	15,020	15·8
Pembroke	98,411	1,781	38,500	39·1
Radnor	37,434	48	1,340	3·6
WALES	940,608	13,195	268,950	28·6
ENGLAND & WALES	7,340,955	29,117	1,039,310	14·1
Aberdeen	210,287	171	15,264	7·3
Angus	61,707	96	10,357	16·8
Argyll	61,652	510	18,657	30·3
Ayr	147,769	2,144	132,090	89·3
Banff	52,778	38	2,777	5·3
Berwick	31,583	42	3,184	9·8
Bute	10,474	333	9,617	91·8
Caithness	25,198	142	3,135	12·4
Clackmannan	4,554	26	1,835	40·3
Dumfries	98,006	1,322	71,938	73·4
Dunbarton	16,095	218	10,539	65·5
East Lothian	14,606	38	2,742	18·8
Fife	57,477	282	18,855	32·8
Inverness	50,741	64	3,651	7·2
Kincardine	34,808	44	4,011	11·5
Kinross	8,354	44	2,806	33·6
Kirkcudbright	71,365	759	49,202	69·0
Lanark	91,285	1,190	65,070	71·3
Midlothian	23,017	174	9,225	40·1
Moray	28,218	42	3,526	12·5
Nairn	7,842	18	1,340	17·1
Orkney	46,978	95	2,945	6·3
Peebles	11,150	152	6,282	56·3
Perth	85,500	204	13,491	15·8
Renfrew	30,170	372	19,687	65·3
Ross & Cromarty ..	37,588	39	2,098	5·6
Roxburgh	32,853	55	3,404	10·4
Selkirk	5,954	37	1,173	19·7
Stirling	40,084	353	18,295	45·6
Sutherland	9,479	31	532	5·6
West Lothian	14,663	110	6,077	41·4
Wigtown	69,699	558	46,364	66·5
Zetland	7,309	1,924	6,306*	100·0
SCOTLAND ..	1,499,243	11,627	566,985	37·8
GREAT BRITAIN	8,840,198	40,744	1,606,295	18·17

*All cattle herds in Zetland are attested. This figure represents the number of animals in the last test of the herds.

* * * * *

ANIMAL DISEASES RESEARCH ASSOCIATION

Work Reviewed by Dr. Russell Greig

The work of the Animal Diseases Research Association since its formation in 1920 was reviewed by Dr. J. Russell Greig, C.B.E., Director of Research, at the annual general meeting held at Moredun Institute, Gilmerton, Edinburgh (states the *Scotsman* in its issue of July 21st).

At the time the association was formed, Dr. Greig said, they were confronted by many major obscure problems of disease. In sheep they were braxy, lamb dysentery, louping-ill, scrapie, pine, enzootic ewe abortion, lambing sickness, pregnancy toxaemia, swayback, yellowsis, orf, enterotoxaemia and pulpy kidney disease, tick pyaemia, tick-borne fever and black disease (although the existence of the last two was then unknown), and there were also worm infestations. These were 16 problems of great economic importance.

To-day, of these, nine could be completely controlled and two could be partially prevented by specific measures. In respect of the remaining five diseases, the cause of four of them had been determined, although specific means for their prevention had not yet been found. The cause of only one—yellowsis—had yet to be discovered.

The major bovine diseases comprised tuberculosis, contagious abortion, mastitis, foot-and-mouth disease, Johne's disease, and the obscure group of metabolic disorders of dairy cows, such as milk fever, lactation tetany and acetonaemia. Of these eight, four could now be completely prevented or rapidly cured. Three of them could be largely prevented, and in only the remaining one—Johne's disease—although its cause was known, were they still without the means of cure or effective prevention.

The great scourge of pig husbandry—swine fever—had now lost its terrors by the provision of a safe and effective vaccine.

The problem of the major specific disease of the horse—grass sickness—remained still unsolved; although during the last 30 strenuous years much information about its nature had been laboriously amassed, and this data pointed to its being due to an infective agent, probably a virus, experimental evidence of the nature of its cause had yet to be determined.

Moredun Institute, Dr. Greig said, had made its contribution to the study of every one of these problems with the exception of swine fever. It was true that in the case of some of them, the part they had played had been quite a minor one. On the other hand, in several of them the association had been very largely if not entirely responsible for their solution.

Spirit of Free Enterprise

Sir Patrick Laird, C.B., Secretary to the Department of Agriculture for Scotland, referring to the work of the association, said it was a very good example of the operation of the spirit of free enterprise, as evidenced by the support it was given from agricultural bodies and private individuals. It would be regrettable, he commented, if the whole burden of supporting work of this kind—and with the burden, of course, went the calling of the tune—were to fall upon the State, because quite obviously that would hamper the spirit of free enterprise in scientific enquiry which was so valuable.

They were all glad the State had given more recognition than previously to the status and value of scientific workers, whether inside or outside the Civil Service. It was high time that there should be some improvement in the general scale of pay and conditions of service of scientific workers. He thought that had been very well recognised in recent years. It was important, because there was a great scarcity of qualified scientists at the present time. There were not enough to do the work that ought to be done.

The land available for food production throughout the world was very far short of the needs of the human population, and therefore anything that could be done to increase food production—whether by improving yields in the case of crops, or by improving the yield of milk in the case of livestock, or by the elimination of losses through disease—was a thing to which they must devote all possible attention.

Mr. George G. Mercer, C.B.E., Southfield, Dalkeith, who presided at the meeting, was re-elected President of the association; Mr. Alex. M'Callum was re-elected Vice-President, and the Duke of Buccleuch was reappointed Honorary President.

* * * * *

Experiments on Animals

"What amount of suffering is it legitimate to inflict in the course of experiments on animals?" is the enquiry posed by correspondents* in a letter to the *Lancet* of August 6th (followed by another instance of the abuse of the experimental system given by Dr. F. Golla), which proceeds: "The question has arisen from a study of some papers published in recent years and describing Canadian and American experiments calculated to inflict the maximum of injury consistent with the temporary survival of the animals, which are then studied physiologically. A special machine has been designed in which unanaesthetised rats, with paws bound together, are dropped 40 times per minute. In one experiment ten rats were subjected to 700 falls in 17½ minutes and died on the average 50 minutes later; another ten subjected to 800 falls in 20 minutes died on the average in 47 minutes. The animals were not unconscious. In another experiment 30 dogs, temporarily anaesthetised, had their thigh muscles contused by 700 to 1,000 blows with a light rawhide mallet on each leg. The anaesthetic was then at once discontinued; 25 of the dogs died after intervals varying from 50 minutes to about nine hours. References to the papers describing these and other exceptionally painful procedures will be given to responsible enquirers on request.

"We should be the last to underrate the importance of experiments on animals; but that importance does not override all other considerations. There must be a limit to the doctrine that the end justifies the means. The 1912 report of the Royal Commission on Vivisection, five of whose seven signatories were eminent medical men, recommended the principle that is now embodied in the pain rule attached to British vivisection licences: 'If an animal at any time is found to be suffering severe pain which is likely to endure,

*Mr. John R. Baker, D.Sc., Sir Frederick Bartlett, F.R.S., Professor A. C. Hardy, F.R.S., Mr. E. Hindle, Sc.D., F.R.S., Major C. W. Hume B.Sc., Mr. W. R. Wooldridge, PH.D., M.R.C.V.S.

such animal shall forthwith be painlessly killed.' This rule applies even when the main object of the experiment has not been attained.

"We therefore invite scientists to assert with us that treatments of the kind to which we have referred at the beginning of this letter are to be condemned as shocking to abnormal human conscience. We suggest that in planning his procedure every experimenter should earnestly consider whether the infliction of the pain involved is really justifiable in the interests of medicine or science, and try to devise techniques that will reduce suffering to a minimum."

The Position Reviewed

In its editorial columns *The Lancet* passes the following comment:—

"Most people in Great Britain regard laboratory experiments on animals as an unpleasant necessity. They accept the practice because so much good has come of it; but they have ensured by legislation that it shall be used as sparingly as possible, kept in the hands of those believed to be humane and responsible, and safeguarded by legal restrictions from abuse. This position has not been reached by following any principle to its logical conclusion. Indeed, principles carried to that extreme, and then used as rules of conduct, often prove cruel or silly or both. Clearly it is as wrong to let a child die unnecessarily of diphtheria as it is to regard all animals as a lower creation designed to suffer for the benefit of man. Though both attitudes can be justified on principle, both offend our humanity. We are thus compelled to treat this like other moral dilemmas, and pick our way uneasily along a middle course, never wholly at peace with our consciences, but at least sparing them the final outrage of one gross evil or the other.

"Certainly the compromise owes nothing to callousness. As long ago as 1871 the British Association for the Advancement of Science resolved that no experiment which can be done under an anaesthetic should be done without it; that no painful experiment is justifiable for the mere purpose of illustrating a law or fact already demonstrated (*i.e.*, such experiments should not be used in teaching); and that when, to obtain a new fact, it is necessary to undertake a painful experiment, every effort should be made to ensure success, so that pain is not inflicted uselessly. The Cruelty to Animals Act of 1876 was founded on this outline; it obliges those who wish to conduct painful experiments, or 'any procedure calculated to interfere with the normal health and comfort of an animal,' to obtain a licence from the Home Secretary; and it further requires that an animal suffering from severe pain which is likely to endure should forthwith be painlessly killed, whether the main object of the experiment has been attained or not. Moreover, there is now a well-grown opinion among scientists that animals should not be used in large numbers for painful experiments if the facts can be established equally well by the use of a few. Within this frame of regulations and customs it is possible to limit painful experiments to a very small proportion of experiments as a whole, and to ensure that the suffering experienced is not severe or prolonged.

"In other Western European countries, and in America, though most scientists doubtless impose on themselves the same humane scale of values, there are not the same stringent legal safeguards. It will always happen that the tough-minded and the tender-minded will differ over what constitutes suffering for others, whether humans or animals, and there will thus always be a scatter round the mean of ordinary practice in the conduct of experiments. But there may also be examples at which the average laboratory worker and the ordinary citizen alike revolt, as is shown in our correspondence columns this week. Charles Darwin held that to inflict any pain which is not absolutely necessary deserves 'detestation and abhorrence,' and all research workers of integrity subscribe to this judgment. They know that to apply the criterion of necessity calls for unremitting care and attention; but they also know that it can and must be done. Since the pursuit of a new fact can sometimes engross the mind almost completely, they recognise that they must always be on guard; and that wherever their keenness may have impaired their sense of proportion they should seek the help and criticism of colleagues. In the cases cited by our correspondents the essential criterion was not applied."

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MINISTRY OF AGRICULTURE NEWS SERVICE

Sheep Recovery

The ploughing-out campaign and the priority given to milk production during the war has greatly reduced the number of sheep in this country. In 1939 the total for England and Wales was 7,000,000 breeding ewes; by 1948 it had fallen to 4,000,000. This decline in sheep numbers was greatly accelerated by the disastrous winter of 1946-47, when there were heavy losses amongst all classes of sheep. These losses were particularly severe on the hills and foothills—the source from which most of the cross-bred ewes come for use in the lowlands. The call for an increase in our livestock was, therefore, severely handicapped as far as sheep were concerned. The need for an increase in our grass-eating, meat-production animals was never as great as it is to-day. Sheep are particularly valuable in this respect, since, in addition to multiplying fairly rapidly, they can be maintained and fattened entirely on grass without the aid of imported feeding-stuffs. If the sheep flocks of this country are to be built up quickly to help meet the needs of the nation, it will be necessary to use for breeding purposes second-cross females that were formerly sold off fat. Some second-cross ewes are excellent mothers and, when mated to a suitable down ram, produce choice lambs.

A demonstration was held recently in Northampton to illustrate the parental stock of some first- and second-crosses and how best they could be used to speed up supplies of home-grown mutton and lamb. Some 30 pens of sheep, pure breeds and crosses, were on view. The demonstration was arranged by the East Midland Province of the National Agricultural Advisory Service, in conjunction with the National Farmers' Union and the National Union of Agricultural Workers. Mr. W. A. Stewart, Principal of the Northamptonshire Institute, Moulton, Northampton, was the commentator.

Beginning with the hardy hill breeds, represented by the Swaledale and the Blackface, Mr. Stewart reminded his audience that the hill breeds were the foundation stock from which excellent first-crosses were obtained. When crossed with the Wensleydale and Border-Leicester ram, respectively, the Swaledale and the Blackface produced the well-known Masham and Greyface. The parental stock of the ever-popular true Halfbred ewe, the Border-Leicester ram on the Cheviot ewe, was also seen. These are common first-crosses. Dealing with second-crosses, Mr. Stewart explained that the Halfbred ewe has been mated to every known breed of Down ram, one of the most popular second-crosses being the Suffolk ram on the Halfbred. This, in turn, produces an excellent breeding ewe. Some splendid ewes were shown to demonstrate this latter cross. The Halfbred-cross Suffolk ewes were shown with lambs by Oxford, Hampshire and Wiltshire Horn rams, respectively. In all cases the lambs were extremely well grown, indicating that the mothers were good milkers.

Mr. Stewart spoke on the advantages of keeping a pure-bred flock of grass sheep, and pens of Kerry Hill and Clun Forest ewes and lambs and pedigree rams were shown as examples of suitable pure breeds.

A breed of sheep common in Northamptonshire is the Wiltshire Horn. Both ewes and rams of the pure breed were on view. Mr. Stewart stressed the early maturing qualities of the Wiltshire Horn, and an interesting feature regarding this breed is the fact that they produce very little wool. The latter can be a distinct advantage from a meat-producing point of view; Mr. Stewart explained that twice as much food is needed to produce a pound of wool as to produce a pound of meat. A pen of Welsh Mountain ewes, with lambs by a Wiltshire Horn ram—as large as their dams—evoked considerable interest.

A feature for many years at Moulton has been the small flock of Dorset Horn ewes. The pure Dorset Horn breed was shown; also ewes with lambs by a Hampshire ram. Lambs of this cross, born in March, were already turning the scale at 135 lb. apiece (June 29th). Dorset Horn ewes are capable of breeding at any time of the year and the practice at Moulton is to lamb down in March and November of one year and in the following July, thus producing three crops of lambs in two years. Both ewes and lambs looked remarkably fit.

The amount of interest taken in sheep at the present time was reflected in the large attendance at this demonstration.

The Upward Milk Curve

The Minister of Agriculture (Mr. Tom Williams), replying to questions in the House of Commons on July 7th, said that the average output of milk for human consumption in Great Britain for the three pre-war years is estimated at about 1,480 million gallons. The corresponding output for 1945 is estimated at 1,525 million gallons, for 1948 at 1,707 million gallons, and for the year ended May, 1949, at 1,794 million gallons.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

β-NAPHTHOXYETHANOL: A NEW ANAESTHETIC FOR USE IN THE HORSE

Sir,—During the routine investigation of various chemical compounds for anthelmintic activity, one, β-naphthoxyethanol, was observed to have a marked hypnotic effect on mice. At the suggestion of our colleague, Dr. F. L. Rose, this compound was investigated as a possible anaesthetic agent in the larger domestic animals. Trials have shown that it is indeed a useful short-acting agent in the horse. The work is of particular interest for several reasons; the clinical signs indicate an ascending anaesthesia, the anaesthesia is of short duration and the drug is administered intravenously as a suspension.

The compound is a white crystalline substance not readily soluble in any solvents which are non-toxic on parenteral administration. For this reason 10 per cent. w/v aqueous suspensions of the compound,* which are virtually non-irritant, have been used. Preliminary experiments in rats, rabbits, lambs and calves suggested that the pharmacological action of the compound in these species was similar to that observed in mice. In the horse the suspension, which must be given intravenously owing to very rapid elimination from the blood stream, can be administered conveniently with the horse standing, giving the required dose of 30 to 50 mg./kg (18 to 40 gr./cwt.) over a period of two minutes, at the end of which the animal will collapse quietly without excitement. Such a dose produces light surgical anaesthesia lasting ten to 15 minutes, when rapid and complete recovery occurs in about five minutes.

When light surgical anaesthesia of the trunk and limbs has been attained by such an induction dose, the head and neck righting movements, volitional eye movements, whinneying and hearing are still present, although suppressed; voluntary movements of the limbs are entirely abolished, although the animal is able to move its limbs as part of a body righting reaction. Cutaneous anaesthesia is good and persists when the anaesthesia is very light. If the compound be injected until twice the dose required for induction is given, the deeper planes of surgical anaesthesia can be readily obtained. At these planes the head and neck movements are absent, the volitional eye movements and corneal and pupillary reflexes are abolished and the animal shows no evidence of perceiving outside stimuli of any kind. Recovery from these deeper planes is rapid and similar to that from the lighter plane.

The toxicity of the drug is low and is largely related to the rate of the injection. When the injection rate is not greater than 0·25 to 0·35 mg./kg. per second, the therapeutic ratio is at least 4 to 5 to 1. If, however, the injection rate is increased and reaches 1·5 to 2·0 mg./kg. per second, respiratory arrest will occur with therapeutic doses. With intermediate injection rates transient signs of cardiovascular disturbances are observed.

Anaesthesia can be induced repeatedly on the same or successive days without any special additional hazards. The drug can be used in combination with chloroform, chloral hydrate and the barbiturate drugs.† No special pre-anaesthetic treatment or medication is usually necessary.

The actions of the drug in cattle, sheep, pigs, dogs, cats and poultry have been investigated. In these animals the drug is much less satisfactory and we recommend that the drug should for the present be used only in the horse.

Thanks to the active co-operation of many of our professional colleagues, of whom we would thank especially the Director of the Royal Army Veterinary Corps, Colonel C. H. S. Townsend, and many officers at the R.A.V.C. Depot, Melton Mowbray, Mr. J. Berger, Mr. J. Adamson, Jr., Mr. T. N. Gold, Mr. Greer and Dr. C. W. Ottaway, we have been able to assemble data on over 300 anaesthesias, including a series of 55 consecutive surgical cases. These data, a full account of which will be published in due course, suggest that β-naphthoxyethanol may be a valuable addition to the group of equine anaesthetic agents, particularly for anaesthesia of short duration.

Yours faithfully,

JOHN FRANCIS.
H. B. PARRY.

Biological Laboratories,
Imperial Chemical (Pharmaceuticals), Ltd.,
Wilmslow, Cheshire.

* The 10 per cent. aqueous suspension of β-naphthoxyethanol is known commercially as "Anavenol" (Registered Trade Mark of Imperial Chemical (Pharmaceuticals), Ltd.). See also United Kingdom Pat. No. 590927.

† Patent protection pending.

PHENOTHIAZINE AND OESOPHAGOSTOMIASIS

Sir,—In the course of the discussion on "Control of Parasites in Relation to Preventive Veterinary Medicine," published in the *Record* for May 7th, 1949, Dr. le Roux and Miss Russell commented on the efficiency of phenothiazine in control of oesophagostomiasis (*Oe. columbianum*) in sheep. Dr. le Roux reported disappointing results in South Africa and Miss Russell stated that, whereas control of the disease was every effective in Canada, she understood that results in Australia had not been quite so good. She thought it possible that the strains of the parasite in Australia and South Africa were more resistant to phenothiazine.

Although it may be that the strains are different—they have certainly been isolated for a good many generations without infusions of "new blood" or "outcrosses"—epidemiological considerations could account for the differences referred to by Dr. le Roux and Miss Russell.

Comparatively little has been published about observations on phenothiazine in South Africa. One does not know whether the drug has been given very extensive tests under the epidemiological conditions which prevail in that region. Without this information one cannot make a close comparison with the findings in other regions in which the drug has been widely used.

The efficiency of phenothiazine against *Oe. columbianum*, like that of any anthelmintic against any parasite, is variable. In a series of trials at the McMaster Laboratory, in which the dose rate was considered adequate for high efficiency, the percentage of worms removed ranged from 30 to 100. In 159 sheep, 100 per cent. efficiency was attained in 35·2 per cent., 70 to 100 per cent. efficiency in 79·8 per cent., and efficiency was less than 50 per cent. in 8·1 per cent. of the sheep.

In Australia we have tended to use phenothiazine rather conservatively because of its cost. If larger doses had been used, control of oesophagostomiasis would have been more effective and more rapidly achieved. From a curative point of view, a level of efficiency is accepted which may be a good deal lower than that required to reduce the output of worm eggs as much as possible, *i.e.*, for epidemiological or preventive use.

The long sojourn of *Oe. columbianum* larvae in the bowel wall complicates control. This is well shown in trials at this laboratory, in which sheep infested by natural exposure during spring, summer and autumn were isolated in concrete pens in late autumn. A flock of 35 such sheep was divided into groups which were treated with phenothiazine at intervals during the next 12 months. One group, treated during the fifth, ninth and twelfth months after isolation, passed an average of 96·6, 27·8 and 20·4 worms per sheep respectively on these occasions and among the worms passed there were always a few immature forms. Large doses of phenothiazine were used for these treatments and it is almost certain that in most instances all the adult worms that were present on each occasion were removed.

It is apparent, therefore, that larvae may continue to emerge from nodules, and complete their development in the lumen of the gut, for at least a year after infestation has occurred. Therefore, *in the absence of reinfestation*, this parasite will persist in a flock for long periods, in spite of repeated treatments.

Adequate control of oesophagostomiasis in Australia calls for a programme of treatment and management lasting several years until the worm population is reduced to very low levels. Eradication may be possible in parts of the affected area of Australia, but would be costly and is, generally, impracticable.

In Canada it appears that control has been so highly successful because climatic conditions and the method of sheep husbandry favour it, and not because the parasite in that country is more susceptible to phenothiazine. Further, the doses used in Canada were greater than those used in Australia. In Australia sheep are never housed and in a large part of the region in which oesophagostomiasis occurs (see map in Gordon (1948b) *Qd. agric. J.* **67.** 33) temperatures are high enough throughout the year to permit development of the free-living stages. In the areas of lower rainfall, moisture (as rainfall) is almost certainly the limiting factor. In some sections of the region, *e.g.*, the northern tablelands of N.S.W., winter temperatures are low enough to prevent development of the free-living stages for a month or so. In eastern Canada sheep are only at pasture for about six months, and even then it is generally too cold for optimum development of the eggs and larvae of *Oe. columbianum*. Swales (1940), *Canad. J. comp. Med.* **4.** 155, recorded that, in lambs placed on pastures in May, no adult *Oe. columbianum* were found until September, and he suggested that June was the earliest at which the infestation would have been acquired by infection of larvae. Comparing the climate of eastern Canada with

that of the northern tablelands region of N.S.W., the coldest areas within the geographical range of *Oe. columbianum* in Australia, suggests that whereas in Canada three or four months at the most are warm enough for the development of the free-living stages, at Armidale (northern tablelands of N.S.W.) nearly eight months are warm enough. The climate of the sheep-raising areas of South Africa, in which a summer rainfall prevails, is not unlike that of the northern tablelands of N.S.W.

It appears that larvae picked up in August-September (autumn) in eastern Canada have about eight months in which to complete their developmental sojourn in the bowel wall and to return to the lumen in time to be destroyed by phenothiazine before the sheep is returned to pasture. If development is completed in a shorter period, the resultant eggs will not lead to further infestation because they will be passed either in the barn or into an unfavourable environment on pasture. In Australia and South Africa larvae picked up in April (late autumn) must complete development by the end of August at the latest, if the resulting adults are to be killed by a strategic dose of phenothiazine before the weather becomes warm enough for their eggs to develop. When, as it commonly does, the developmental period exceeds four to five months, the adult worms mature in the bowel lumen during the warmer weather, their eggs pass into a favourable environment and so begins a new cycle of infestation.

It is possible, therefore, to explain the striking effect of phenothiazine in controlling oesophagostomiasis in Canada on epidemiological grounds alone.

Yours faithfully,

McMaster Animal Health Laboratory, Parramatta Road, Glebe, N.S.W. H. McL. Gordon.

July 21st, 1949.

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MEPACRINE HYDROCHLORIDE IN EXPERIMENTAL COCCIDIOSIS IN CHICKENS

Sir,—A report by Wilson (1949)• claimed that mepacrine hydrochloride was of some value in the treatment of caecal coccidiosis in chickens. The concentration of mepacrine hydrochloride used was very low (0·2 grammes to one gallon of drinking water), and if this treatment had been as efficient as sulphonamide treatment the cost of medication would have been greatly reduced. I have, however, repeated his work, and have also used higher concentrations of this drug, but in no case can I demonstrate any curative effect with mepacrine hydrochloride against caecal coccidiosis in experimentally infected chickens.

The first experiment was carried out to repeat as far as possible the conditions of Wilson's experiments. Ten-day-old chickens were infected with sporulated oocysts of *E. tenella* and 24 hours later one group of chickens was treated by introducing mepacrine hydrochloride into the drinking water at the rate of 0·2 grammes per gallon, *i.e.*, 0·004 per cent. For comparison a further group was, at the same time, given sulphamezathine-medicated drinking water at the rate of 4·5 grammes per gallon, *i.e.*, 0·1 per cent. It will be seen from the table below that whereas sulphamezathine afforded complete protection, the number of deaths with mepacrine was similar to the number of deaths in the groups receiving unmedicated drinking water.

Unmedicated drinking water	*Mepacrine* 0·004%	*Sulphamezathine* 0·1%	*Uninfected Controls*
No. in group 21	No. in group 21	No. in group 21	No. in group 21
No. of deaths 13	No. of deaths 16	No. of deaths 0	No. of deaths 0

A second experiment was set up with five-day-old chicks to try out the higher concentration of mepacrine hydrochloride suggested by Wilson which might give a better result. Medication commenced 48 hours after the experimental infection, mepacrine hydrochloride was used at the rate of 1 gramme per gallon of water, *i.e.*, 0·022 per cent., and sulphamezathine at the rate of 9 grammes per gallon of water, *i.e.*, 0·2 per cent. Here again sulphamezathine offered complete protection whereas mepacrine was of no value.

Unmedicated drinking water	*Mepacrine* 0·022%	*Sulphamezathine* 0·2%	*Uninfected Controls*
No. in group 20	No. in group 18	No. in group 18	No. in group 12
No. of deaths 7	No. of deaths 8	No. of deaths 0	No. of deaths 0

A third experiment was carried out on five-day-old chickens and this was a direct comparison of 0·1 per cent. mepacrine hydrochloride with 0·1 per cent. sulphamezathine in the drinking water, introduced 48 hours after experimental infection. It was unfortunate that the death rate in the control group was low, but the fact remains that all the deaths in the mepacrine group were also confirmed on *post-mortem* examination to be due to acute coccidiosis, and it would appear that mepacrine exerted an unfavourable effect. Sulphamezathine, however, again offered 100 per cent. protection.

Unmedicated drinking water	*Mepacrine* 0·1%	*Sulphamezathine* 0·1%	*Uninfected Controls*
No. in group 11	No. in group 11	No. in group 12	No. in group 24
No. of deaths 2	No. of deaths 9	No. of deaths 0	No. of deaths 0

In these experiments medication was continued for seven days, and *post-mortem* examinations of all the deaths recorded revealed that these were due to acute caecal coccidiosis. Infection was caused by dosing orally with sporulated oocysts obtained from the caeca of chickens experimentally infected from a naturally occurring outbreak near Nottingham.

• *Reference.*—Wilson, J. E. (1949.) *Nature.* **163.** 250.

Yours faithfully,

Research Department, Veterinary Science Division, Boots Pure Drug Co., Ltd., Thurgarton, Notts. J. W. G. Leiper.

July 22nd, 1949.

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TESTICULAR NEOPLASM ASSOCIATED WITH SEX INVERSION, IN THE DOG

Sir,—We are indebted to our correspondents, Messrs. A. H. Hogg and E. J. Voute, for their contributions. We must point out that in our paper we referred not to testicular neoplasms in general but to one particular type, which we will term "Sertoli cell benign tumour."

We claimed that sex inversion, with accompanying alopecia, resulted from its presence and could be combated by the injection of chorionic gonadotrophin. We suggested that this produced its results by stimulating interstitial cells to secrete testosterone.

We mentioned that sex inversion and alopecia might result from other testicular conditions, but that we had failed to obtain recovery in such circumstances by the use of gonadotrophin. Our paper did not concern itself with ectopic testicles.

With regard to seminoma, mentioned by Mr. E. J. Voute, we are of opinion that true seminoma, as it occurs in the human male, with marked tendency to early metastasis, is extremely rare in the dog.

Testosterone, in the treatment of sexual disorders, has only temporary effect and requires repeated injections. It is also too costly for general veterinary use. Cortical hormone, though equally costly and not lasting in its effect when injected, might well be worth a trial by implantation in treating the syndromes associated with testicular failure, including those associated with tumours other than the Sertoli cell benign type. We are grateful to Mr. E. J. Voute for his suggestion.

Yours faithfully,

45, St. James' Street, Nottingham. P. W. Daykin.

August 4th, 1949. R. H. Smythe.

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INFECTION OF THE SUPRARENALS IN THE DOG?

Sir,—The following letter is written in the hope that some more learned colleague can give a pointer as to the condition described.

Subject.—Foxhound dog pup, 12 months.

History.—22.7.49.—Noticed by kennelman to be off his feed and disinclined to move.

23.7.49.—Paralysed and apparently in intense pain, more or less localised to lumbar region. Died before I reached the kennels.

Post-mortem examination.—The only macroscopic lesion, other than an intense congestion of the lungs, was an engorgement and enlargement of the suprarenal glands, one of which was some 1¾ in. long × ¾ in. thick at its maximum, and intensely haemorrhagic.

I have ascertained that there is in the human subject an infection of the suprarenals which causes sudden death in intense agony, and should be interested to learn if there are any authoritative records of a similar condition in the dog. Unfortunately the kennelman in his enthusiasm sliced the gland to pieces while I was examining the lungs, so I was unable to forward it for examination.

Yours faithfully,

Chipping Norton, Oxon. Paul Crosfield.

August 3rd, 1949.